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From an appeal broadcast by Sir Winston Churchill, Sept. 16th, 1951

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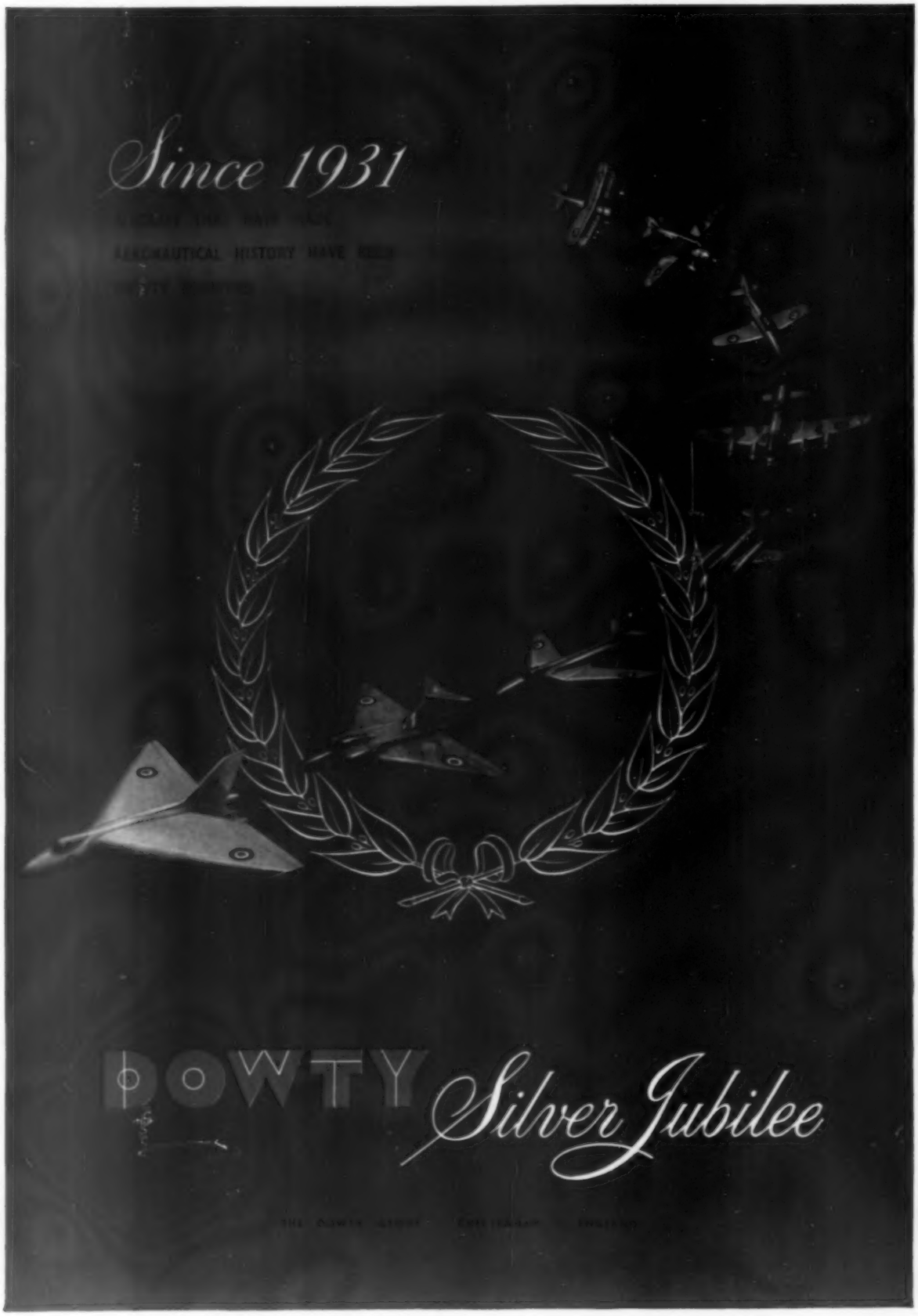
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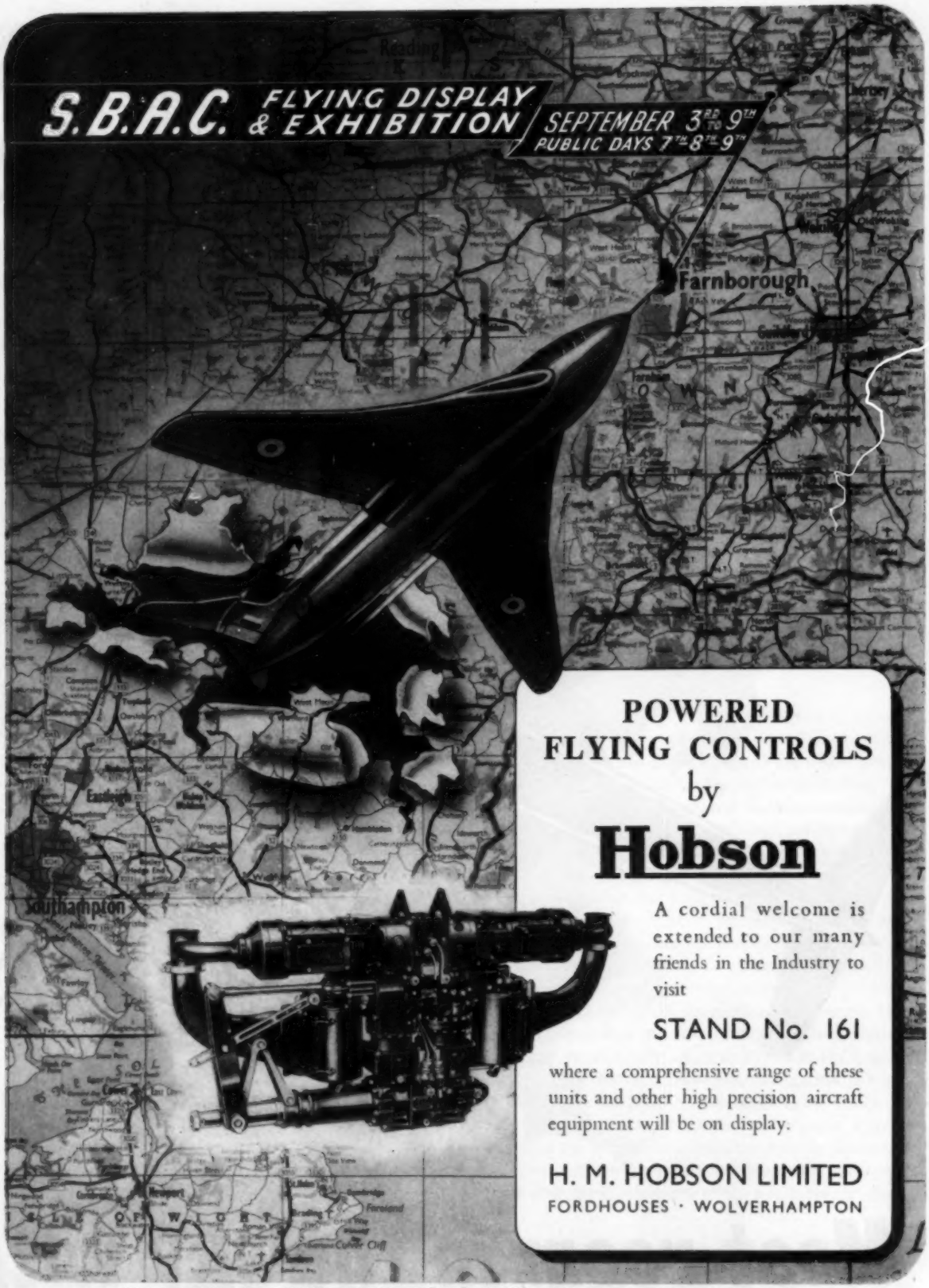

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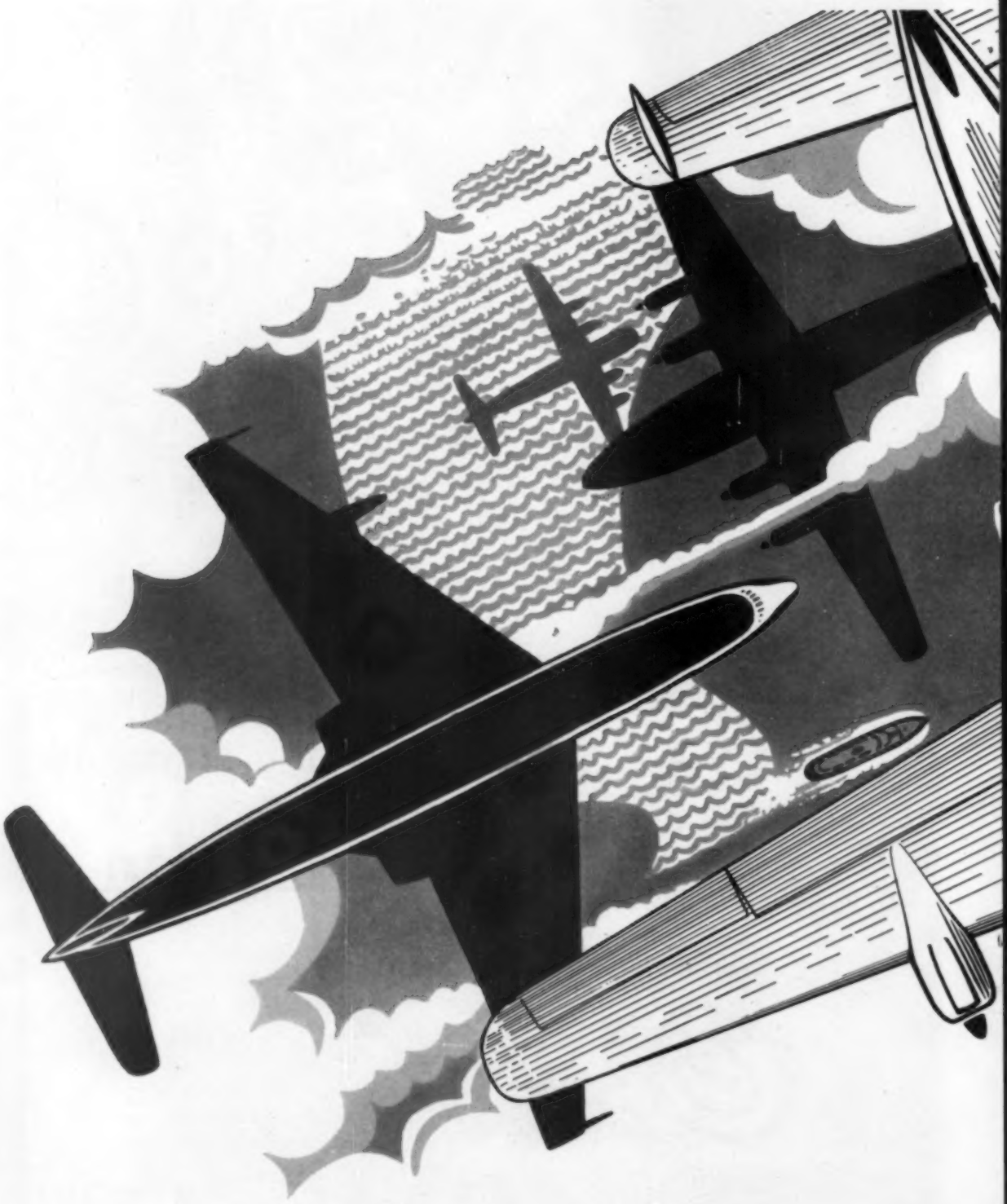

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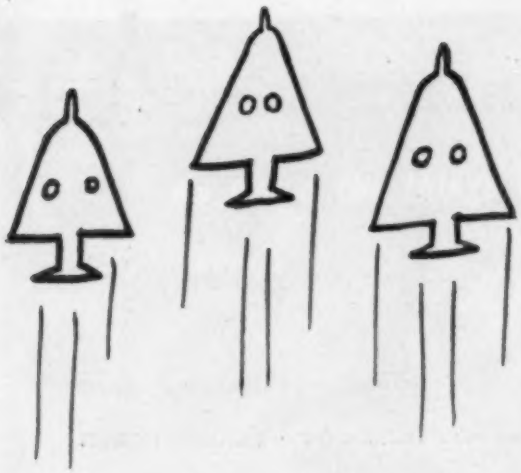

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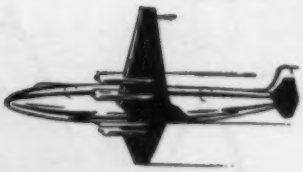

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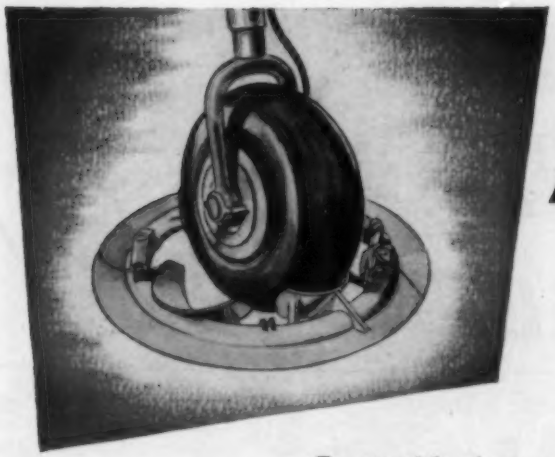

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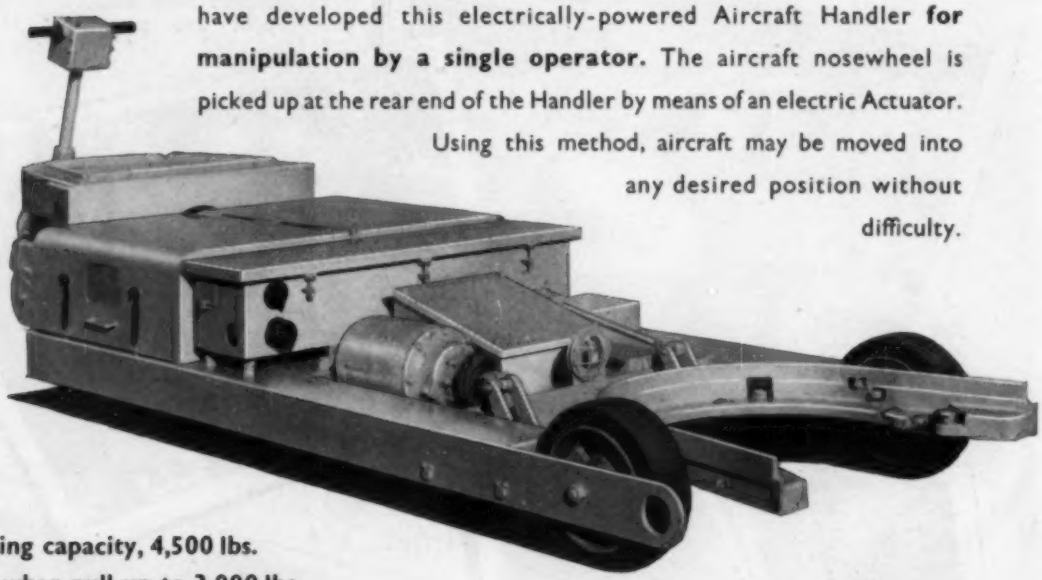

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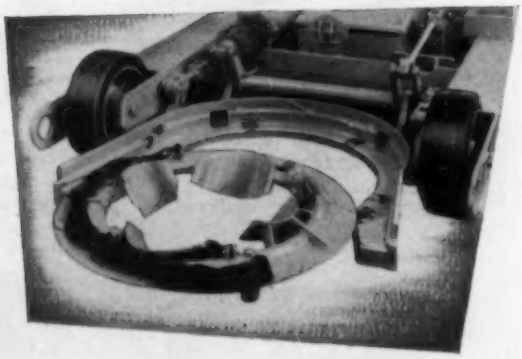

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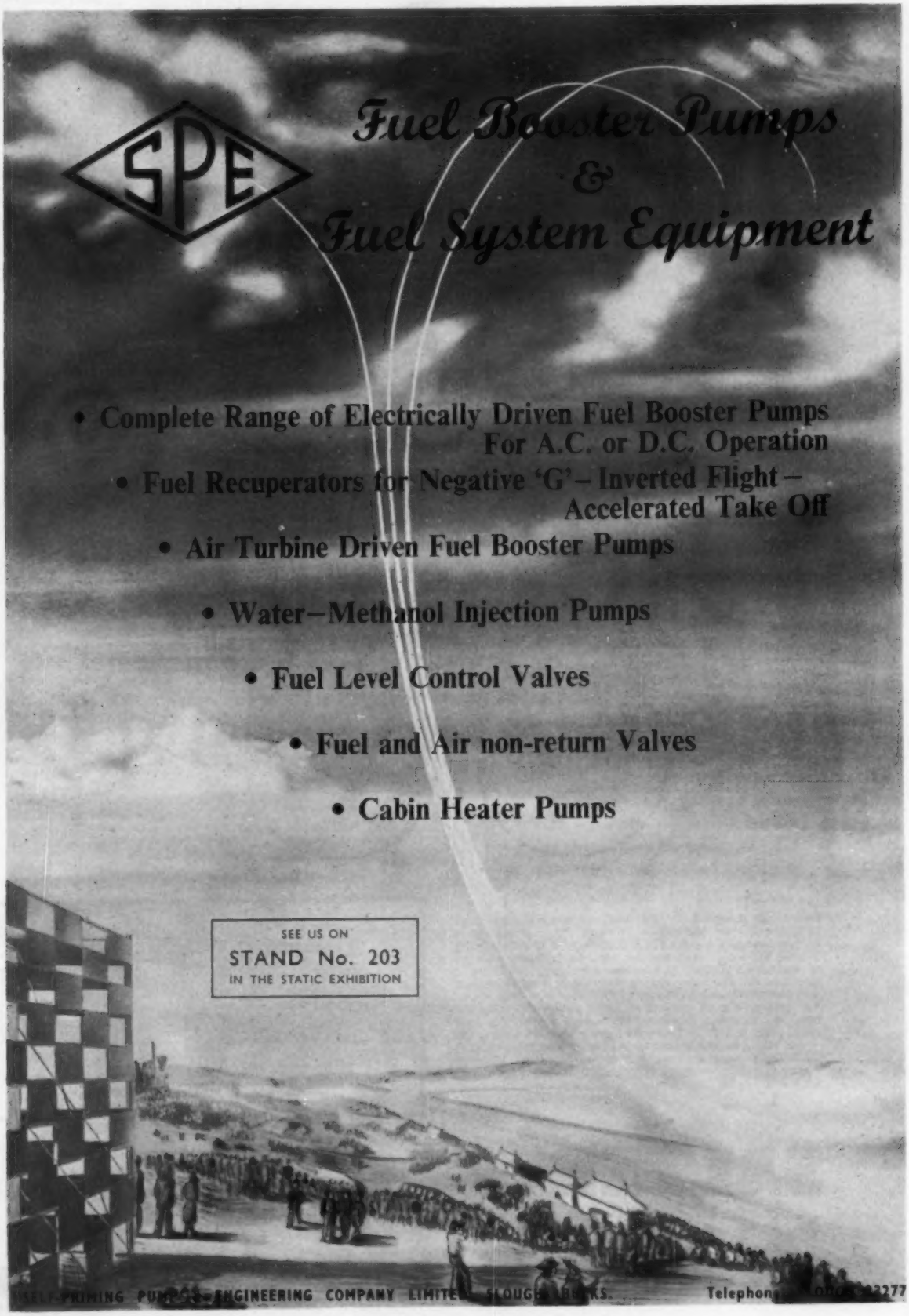
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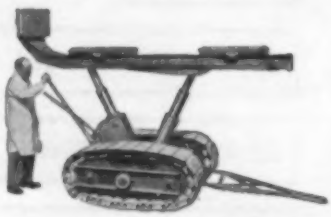

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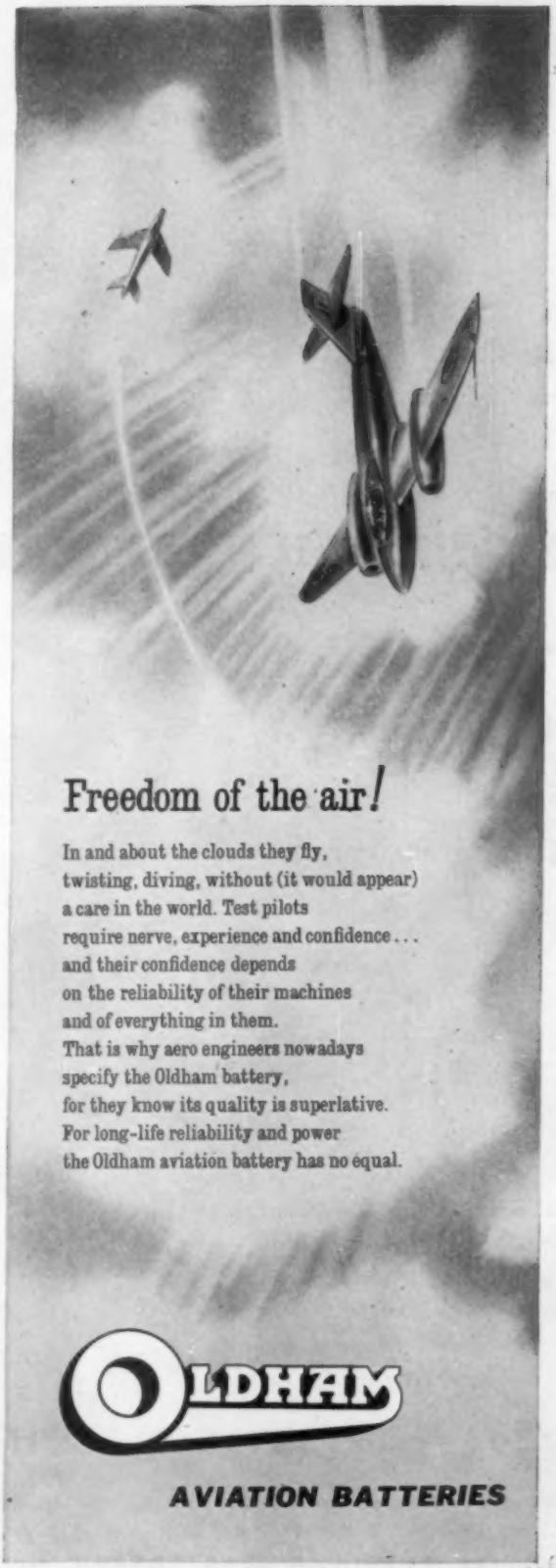

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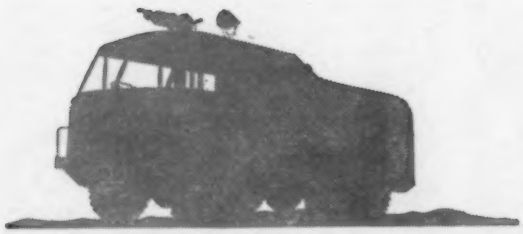

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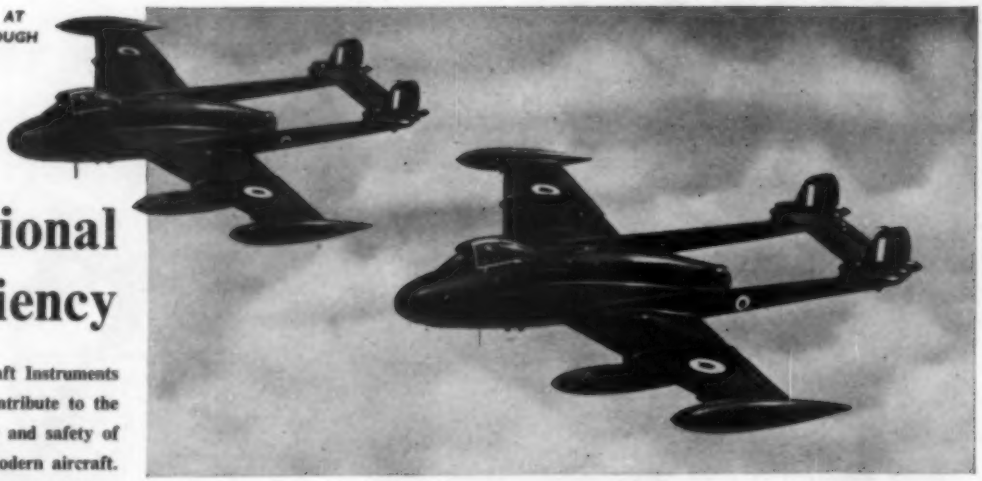

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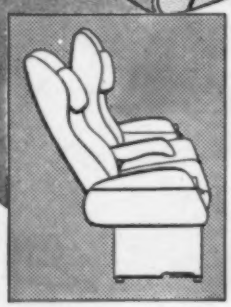

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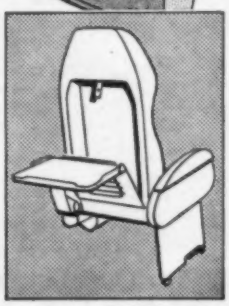

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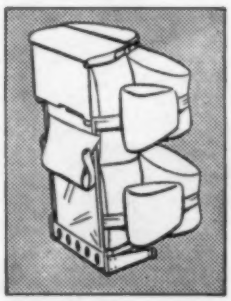

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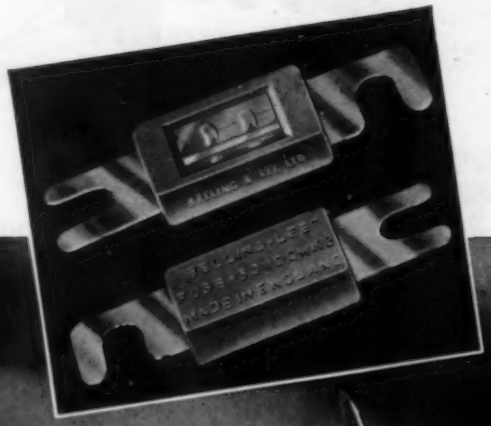

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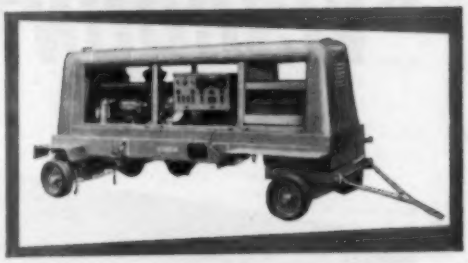

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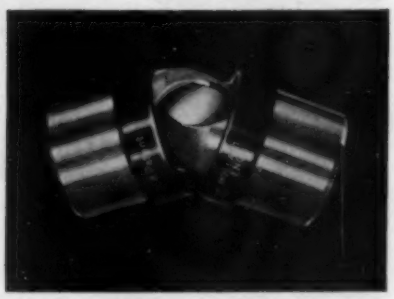

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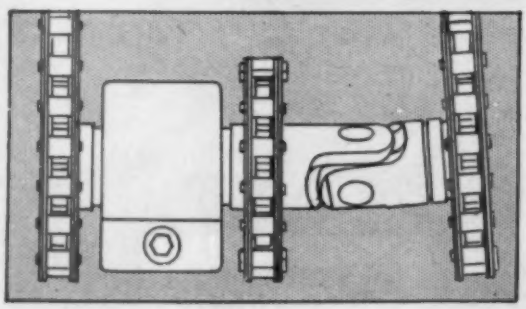

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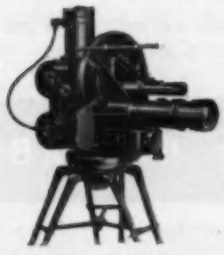

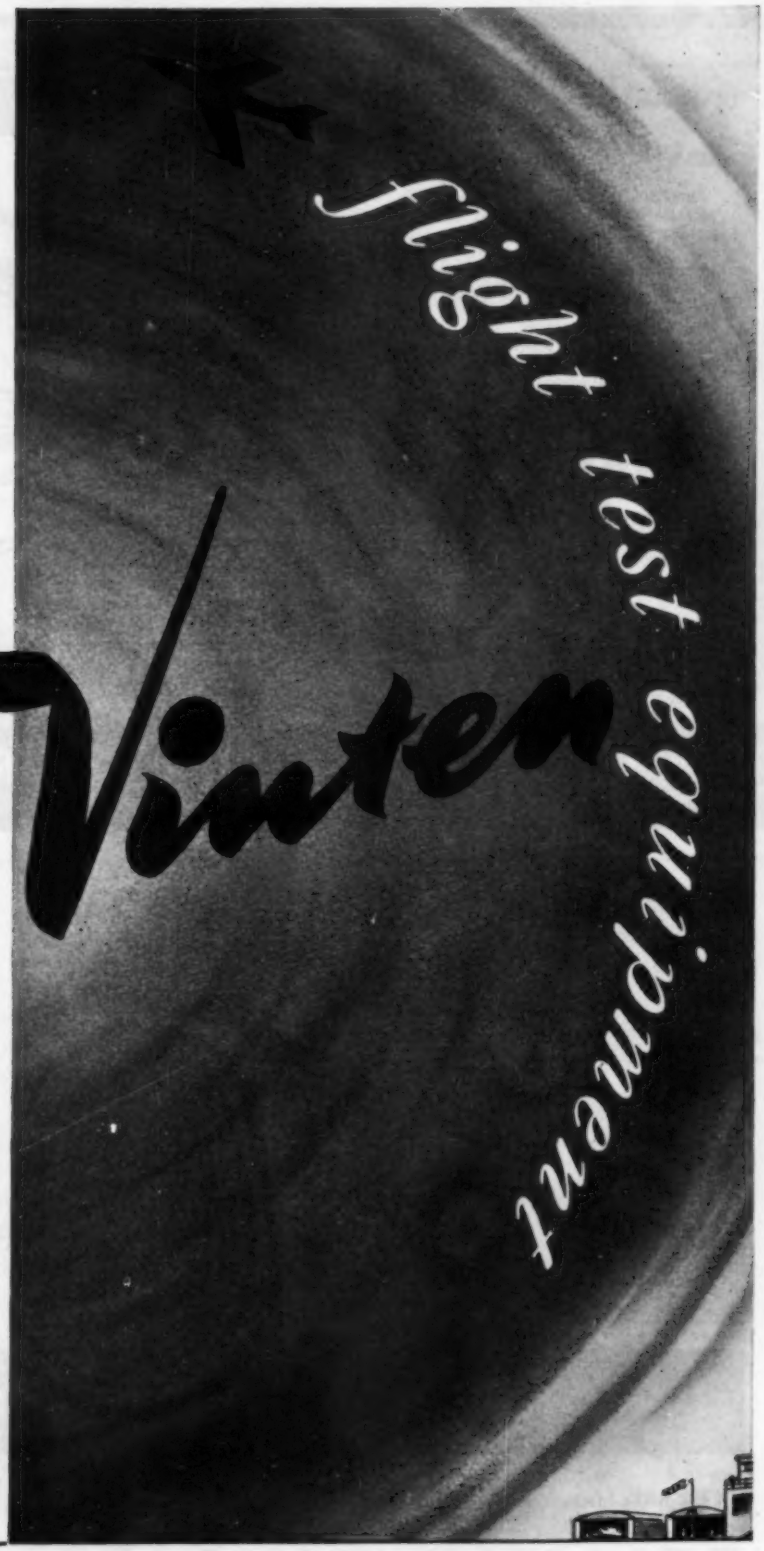

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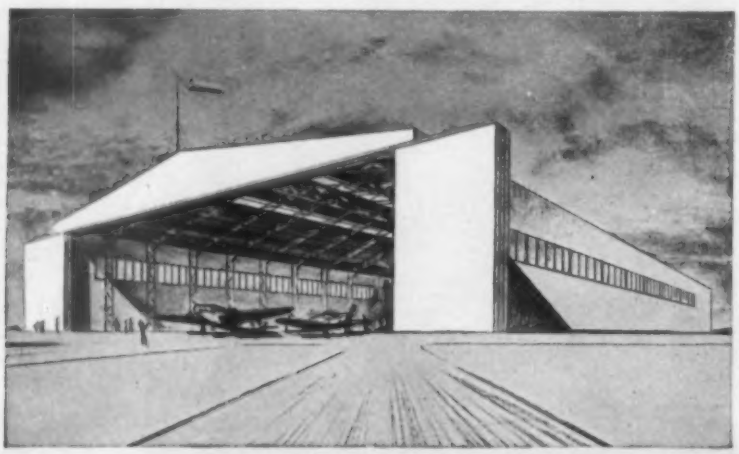

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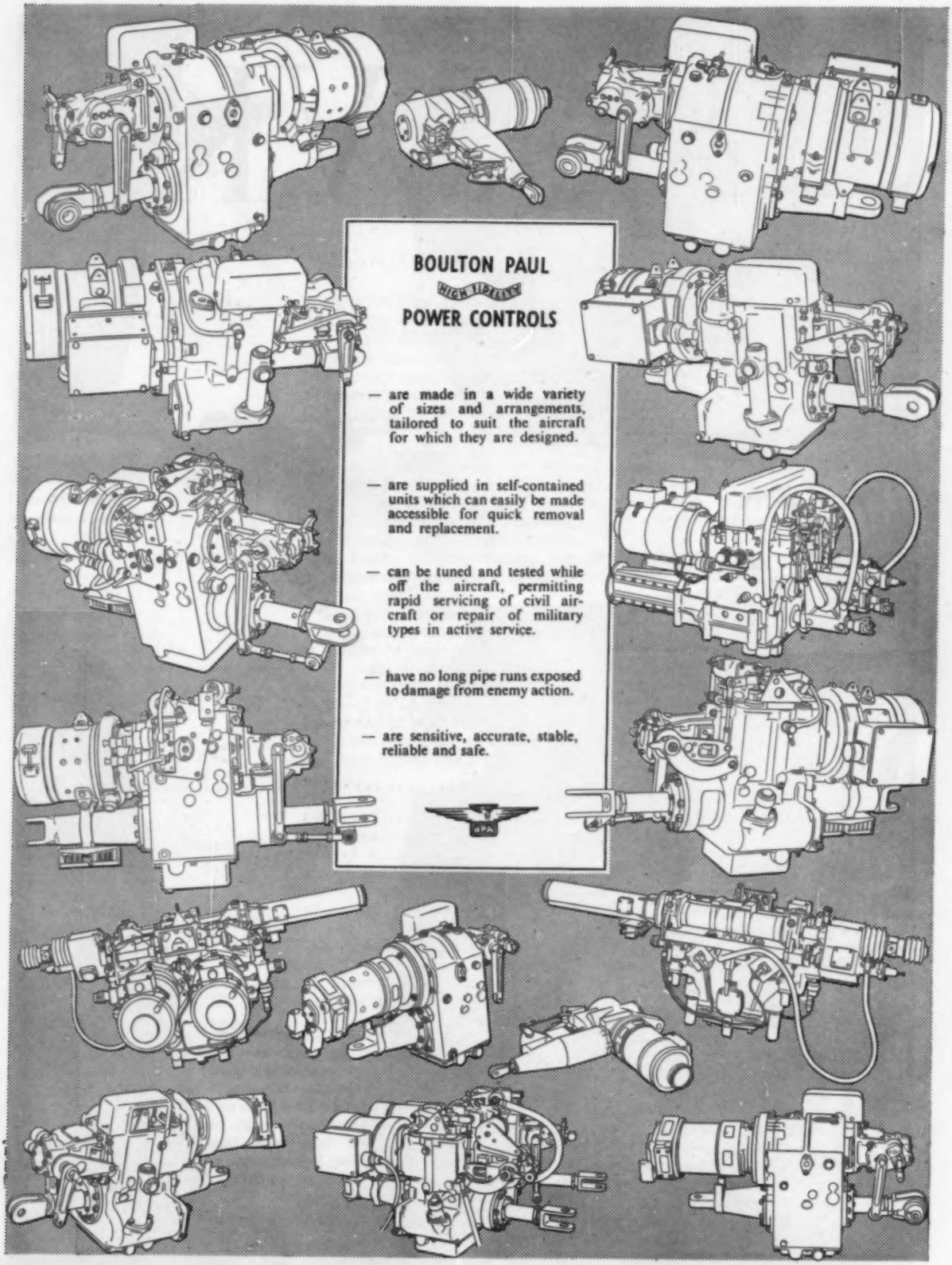
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FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT and AIRCRAFT ENGINEER No 2485 Vol 70 FRIDAY 7 SEPTEMBER 1956

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Thoughts Before Action

WHAT an infernal internal fluttering of butterflies we experienced over the week-end, while the editorial and photographic teams were steeling themselves for the coming assault on Farnborough! But whereas the butterflies were assured of conditions favourable to success the portents for our own venture could hardly have been less sympathetic. The met. chart read with all the promise of a contract cut-back and, rally ourselves as we might with recollections of doughty deeds done in bygone years under the lowest of Farnborough skies, we were quite unable to tap the barometer of our spirits beyond "Set Foul." From the shrouds of their rain-checks American visitors tendered tentative tuppences to sodden newsvendors to be apprised that the P.1 (a golden hope this year—coming in at Mach 0.98, whipping into a 6-g turn, etc.) would be a non-starter. And though, in their good-neighbourly way, they reminded us that a canopy-jinx can settle on the best-regulated development programme, we remained inconsolable—and full of butterflies.

By Sunday morning the met. was beyond profanity and our customary recce of Farnborough appeared the merest folly. On every hand the dirge arose "Nothing new this year."

Then suddenly, as we traversed the Hog's Back, the tiniest speck of blue shone through, and by the time we were on the airfield the whole prospect had brightened at least to the point of hope.

We conclude this on the mellowest of English Sunday evenings, with the sun getting low over Laffan's Plain. Most of the aeroplanes are here; and some of them—if only in respect of equipment—are of uncommon interest. "The static," too, is full of promise, as we have witnessed. What tomorrow may bring later pages will tell. But right now those Farnborough butterflies lie as quiet as if they had been doused by an E.P.9 or Agricola.

Merchant Venturers

THAT small area of London Airport over which the statues of Alcock and Brown now preside has recently witnessed two stirring episodes in the history of British enterprise in the marketing of civil airliners. The first was the arrival home last December of the de Havilland Comet 3 from its "back-in-business" tour round the world. The second, last week, was the arrival home of the Britannia from its dollar-chasing tour of North America.

The customer's polite attentiveness becomes especially eager when the brochure and the sales talk are replaced, or at any rate backed up by, the actual aeroplane which the customer can feel and fly from his own airfield. "Tangible hardware," we believe, is no better than paperware if it is not displayed with vigorous and aggressive showmanship.

But there is another facet of salesmanship no less vital to success, and one which, we believe, is in keeping with the national character. This, paradoxical though it may seem, is the need for belief in the rival product. The "unselling" of the opposition—howsoever absurd some of their claims may seem—is an unconvincing and negative substitute for the straightforward selling of one's own product. We have previously recorded on this page Boeing's reply to our suggestion that the 707 seemed more likely to be on time than the DC-8. "Don't worry," they said, "Douglas will be right on schedule." This reassurance of their awareness of what they are up against did not diminish our confidence in the 707.

We are certain that the tide in the affairs of Britain's civil airliners is being taken at the flood, and that it will lead on to great fortune. And one of the signs, displayed by the Comet and the Britannia, is that the most effective way to deliver a brochure is to wrap it up in the aeroplane concerned and send it by air. That may be an expensive way of sending it; but Mr. Peter Masefield's estimate that the recent American tour cost Bristol about the same amount as a Britannia tailplane put the cost into perspective. It seems likely that many tailplanes, with fuselages, wings and engines attached, will be sold as a result.

FROM ALL QUARTERS

Non-stop Transatlantic Valiant

PILOTED by W/C. L. H. Trent, V.C., a Vickers-Armstrongs Valiant of No. 207 Sqn. flew from Loring A.F.B., Maine, to R.A.F. Station Marham, Norfolk, non-stop in six hours, ten minutes. This was the first indication that the Valiant has trans-atlantic range without air-to-air refuelling.

With W/C. Trent as second pilot on the 2,600-mile flight was A.V-M. S. O. Bufton. They had a crew of four. W/C. Trent was reported as saying afterwards: "We could have done it in considerably better time but for the fact that the usual tail wind was absent and, instead, there was a 120 m.p.h. jet-stream cross-wind." They had been observing the U.S.A.F. Strategic Air Command bombing competition, as reported last week.

The fastest Atlantic crossing, 4 hr 45 min, from Limestone, Maine, to Fairford, Glos, was set up by a U.S.A.F. B-47.

Export Augury

THIS week's S.B.A.C. Show, with its emphasis on saleable products, started with a good augury in the aviation exports figure for July. The total was £9,393,306, which brought the aggregate for the first seven months of 1956 to £65,309,839, less than £1m below last year's record and higher than the value of aviation exports for any other year.

Mercator Protest Rejected

THE Chinese Communist Government has disavowed responsibility for shooting down a U.S. Navy P4M-1 Mercator some 400 miles north of Formosa on August 23 and rejected the American Government's claim for compensation.

A joint statement by the U.S. State and Defence Departments had said they considered the attack was made without warning and was unjustified; that the responsibility for loss of life and destruction of U.S. property lay with the Chinese Communist régime; and that the U.S. Government would submit a demand for compensation, both for loss of life and for the aircraft.

In reply, a Chinese Foreign Ministry statement broadcast by Peking Radio is quoted as saying: "The Chinese Government considers that the charge made by the United States is inacceptable and its demand is groundless." The Chinese Government had already expressed regret, but said that the presence of the aircraft proved that the U.S. Seventh Fleet manœuvres off China were "a planned provocation."

Rotodyne Prospects

SELLING price of the Fairey Rotodyne helicopter, based on a "reasonably large order," would be between £220,000 and £230,000, Mr. R. L. Lickley, chief engineer of the Fairey Aviation Company, announced last week. If orders were received soon after the first machine had completed flight testing, he said, deliveries could begin late in 1960 and be continued "in fair numbers" during early 1961. The date of the first flight of the prototype Rotodyne would depend on the period required for ground-running tests, which was not predictable, but "with luck" it would be the late spring of next year. An illustrated progress-report of Rotodyne development to date, written by the Technical Editor, appeared in *Flight* of August 17.

Air v. Road Contest

AN Auster J.4 aircraft and a Triumph T.R.3 car are to journey from Land's End to John O'Groat's and then to London between September 15 and 21 in a contest to see which uses the less fuel. Each will carry two people.

The competition results from a £50 wager made by the Royal Aero Club to the British Automobile Racing Club that an aircraft carrying two people over this distance would use less petrol than a car. A B.A.R.C. representative is to travel in the Auster and an R.Ae.C. representative in the Triumph. Mr. Harold Best-Devereux, a committee member of the Popular Flying Association, has been nominated to fly the Auster. The Triumph will be driven by Lord Selsdon and Lord Essendon.

Terminal points for the contest are the control tower at St. Just airfield, Land's End; the lighthouse at Duncansby Head, John o' Groats (the aircraft to fly round it and the driver of the car to touch it); and the clubhouse at Elstree.

U.K.-Eire Revised Air Agreement

AS a result of the revised air agreement between the British and Eire Governments (signed in Dublin on August 31), and a new inter-company agreement between B.E.A. and Aer Lingus, B.E.A. and some independent carriers will now be able to operate scheduled services to and from the Irish Republic for the first time since the war. They have been prevented from doing so hitherto by the previous agreement of April, 1946, which gave a monopoly of all services between Eire and the U.K. to Aer Lingus, jointly owned by the Irish and by B.E.A.

Under the new agreement, Aer Lingus will retain a monopoly on certain of their existing routes, including those from Dublin to Glasgow and Edinburgh, to the Isle of Man and to Jersey. But a U.K. airline will now be able to operate "in parallel" with Aer Lingus on two of the busiest routes between the two countries, from London to Dublin and from Liverpool and Manchester to Dublin, as well as on the Birmingham-Dublin route.

As B.E.A., because of their substantial financial holding in Aer Lingus (which will now be reduced from 40 per cent to 10 per cent), has borne a large part of the cost of establishing the services on these routes, the U.K. Government intends to designate the Corporation to operate future services on them.

Initially, B.E.A. will not operate as many services as Aer Lingus, but as traffic increases will gradually build up to equality. The revised agreement also provides for some new services including one to Cork as soon as the city has a new airport.

Soviet Visitors

A SOVIET AIR FORCE delegation led by Chief Marshal of Aviation P. F. Zhigarev, the Commander-in-Chief, arrived in London on Sunday and was due to visit Farnborough on Tuesday and Wednesday (see page 430).

The Russians, whose visit is scheduled to last until next Sunday, were also to tour several R.A.F. stations. These included Honington, Manby, Cranwell, and Little Rissington.

In the Tu-104 with the Air Force delegation, the Soviet Minister for the Aircraft Industry, Mr. P. V. Dementjev, arrived at the invitation of the Minister of Supply. Accompanied by seven experts, he is to go to Farnborough, to one or two aircraft factories (including Vickers-Armstrongs, Ltd., at Hurn) and to the Aerodynamics Section of the National Physical Laboratory.

B.E.A.'s Domestic Fares To Go Up

IN our issue of August 24 we recorded the following brief but significant sentence which appeared in B.E.A.'s annual report for 1955/1956 published on August 22: "In spite of good load factors [domestic] routes do not yet make a profit on total costs . . . It may, therefore, eventually be necessary to make some upward adjustment in fares . . ."

It now appears that this "upward adjustment" will be 10 per cent (except for the London-Belfast fare, which will be increased 6 per cent) and that it may take effect from December 1. This was announced by Mr. Anthony Milward, B.E.A. chief executive, in Belfast on August 29.

B.E.A.'s 1955/1956 domestic deficit (*excluding* allowance for a proportion of total overheads) was £689,445—actually much more than 10 per cent of the total traffic revenue of £4,568,640.

German Aircraft Industry Aims

THE revived German aircraft industry has now received its first contracts for assembling American aircraft under the mutual aid agreement. The "Weser" group, at Bremen, has contracted to assemble 558 F-84s and 26 H-21s. According to the Association of the German Aviation Industry, about 1,000 American aircraft will be assembled in Germany.

The Association has stated that German manufacturers are aiming for the civilian market, with military contracts regarded as providing financial means for getting a start and gaining export openings.

The Focke-Wulf concern, which (as reported in *Flight* for August 31) is to build 194 Piaggio trainers under Italian licence for the Luftwaffe, plans to export this type of aircraft to Scandinavia and South America. The Do 27, already in production as an army co-operation aircraft, will be also sold as a passenger aircraft.

R.F.C. and R.N.A.S. Reunion

AT the Hyde Park Hotel, London, on Friday last, some 520 members of the Royal Flying Corps and Royal Naval Air Service attended the third reunion to be held jointly by the two Services which were amalgamated to form the R.A.F. in 1918.

An illustrated account will be given in a forthcoming issue.

Japanese Expansion

THANKS to American assistance, Japan's air defence force is expected to become "combat-worthy" by October 1957, a speaker on the Japanese radio is reported to have said recently. According to this spokesman (described as "an air force expert") Japan had been "unofficially" assured of the supply of 112 aircraft during the next financial year. Details of these, including 27 all-weather jet fighters required by Japan, were to be discussed by

Mr. Keikichi Masuhara, deputy director of the Defence Board, during his forthcoming visit to Washington.

The spokesman added that several groups of Japanese air force officers and men were now being trained at U.S.A.F. bases in Japan. By September, more bases were to be either returned to the Japanese or to be shared by U.S. and Japanese forces. The Americans were assisting local production of Sabres and jet trainers. From next year, Japan's radar personnel—2,000 of whom had been trained at U.S.A.F. bases—were to be increased annually by 1,000, and by 1960 the Japanese were to take over the entire radar network of their country.

The Polish Industry

DURING recent weeks, news and features broadcast by Warsaw Radio have contained several references to the Polish aircraft industry. Two experts interviewed, Witold Rycerski and Eugeniusz Nadratowski, admitted that things had not gone entirely smoothly since the war. Until new cadres had been trained in Russia there was a serious shortage of skilled workers. Normal aircraft production started in 1952 and, particularly after the "new conditions" had been introduced, progress was rapid. "Jet aircraft of the most modern designs" were now being produced. Another commentator said that all the jet fighters seen at the recent Warsaw fly-past—some of them were supersonic and had afterburners—were built in Poland. Plans for rapid development were now in hand and Poland hoped to be able to export various types of aircraft within a year.

The Lodz Aircraft Factory (say the radio reports) is now designing a "completely new type of jet engine" and a light training aircraft capable of 155 m.p.h. and with a ceiling of 13,100ft. Designed by Stankiewicz, this machine will go into production in the next few months.

The Swidnik (Lublin Province) factory is now building a batch of SM-1 helicopters. They seat pilot and three passengers and are powered by a Russian engine of 570 h.p. The SM-1 is claimed to be capable of speeds up to 162 m.p.h. and a rate of climb of 1,170 ft/min, and to have a ceiling of 16,400ft and a range of over 186 miles. The cabin is heated and the rotor blades have anti-icing equipment. Kits will be available for quick conversion for ambulance and agricultural work and full production will begin early next year. At present there are only five helicopter pilots, all of them trained by the Russian pilot Vionitski, holder of the world height-with-load record.

NEW BELL: Bell Aircraft's new four-seat Model 47J, now on a 17,000-mile tour of Central and South America.

During its recent visit to Warsaw the Tu-104 landed at a new civil airport called Bemowo, located near the village of Babice, north-west of Warsaw. The airport is said to be equipped to full international standards and capable of accepting the latest heavy transports.

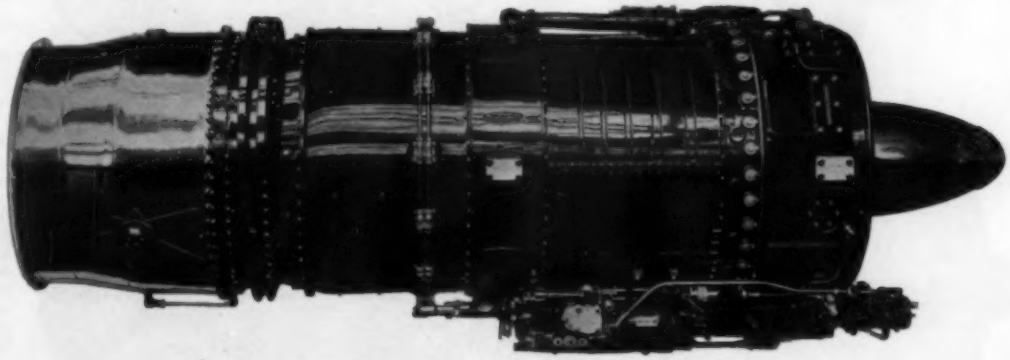
MORE ABOUT THE GYRON JUNIOR

LAST week we announced that the D.H. Gyron Junior was likely to be cleared for public showing in time for the de Havilland Engine Company to prepare an exhibition specimen for display at Farnborough this week. This has in fact proved to be the case. The display engine is illustrated for the first time on this page.

Although no thrust can be quoted for the engine, several foreign observers have placed it in the 8,000 to 11,000-lb class (without afterburner) and this seems perfectly reasonable. The need for such a unit, appreciably smaller and lighter than engines of similar power already in being, was realized several years ago when discussions were held between the various interested parties and the late Major Halford, then chairman and technical director of the company. As a result of these discussions requirements for prototype engines were formulated and put out to tender among various engine firms. It is to the credit of the Ministry of Supply that the specification was forcefully "pushed" in order to produce tangible results in a remarkably short time. The schedule was, in fact, so challenging that it became virtually essential to employ aerodynamics and mechanical features similar to something already in existence. This put the de Havilland Engine Company in a strong position, since the great Gyron turbojet was already successfully running in prototype form and had characteristics ideally suited to those required of the new engine. It was therefore decided that major components of the new engine should be direct scales of the corresponding parts of the Gyron and, with this premise accepted, de Havilland were given the go-ahead and ran the first Gyron Junior in August, 1955.

It is a significant fact that test components were virtually eliminated, yet subsequent running of the prototype Juniors has been eminently satisfactory. It was actually the first engine to be developed entirely at the Engine Company's new headquarters at Leavesden Aerodrome, near Watford, and the prototype Juniors were built on the production floor. The overall direction of the design was, of course, in the hands of Mr. A. F. Burke, who succeeded Major Halford and is now also managing director of the de Havilland Aircraft Company, Mr. J. L. P. Brodie, engineering director, Dr. E. S. Moult, the chief engineer, and his deputy, Mr. F. M. Owner.

No details may be published regarding the interior of the Gyron Junior, but it is possible to comment on what can be seen externally. The most striking factor is, of course, the modest size of the engine, for it is appreciably smaller than earlier turbojets rated at half the thrust. The intake is a straightforward casting, and oil sight-glasses indicate that it incorporates integral oil tankage. There are five radial struts supporting the front bearing, forward of which is a bullet fairing the starter motor and provided with a rearward-facing annular exhaust which presumably acts as an exit for hot de-icing air. The latter is supplied from the compressor delivery manifold through pipes running along the top of the engine and incorporating Teddington gate valves. The ring



This is the display version of the de Havilland Gyron Junior turbojet. No figures for thrust may be quoted but it can be stated that the approximate dimensions are: overall diameter, 32in; intake diameter, 28in; and length, excluding starter bullet, 88.5in.

MORE ABOUT THE GYRON JUNIOR . . .

of circular bearings around the rear of the intake casting suggests that the compressor inlet guide vanes are of variable incidence. Their actuation appears to be effected by a linkage from the accessories arranged along the bottom of the engine.

From the ribbing on the compressor casing one can deduce that there must be roughly seven stages of compression, a number which matches the similar deduction which results from an examination of the company's larger engine (which, incidentally, is sometimes referred to as the Gyron Senior). The compressor casing is split into top and bottom halves, and the entire carcase of the engine is held together by conventional bolts. Behind the compressor is a circumferential manifold in which can be seen the fairings over the outer anchors of streamlined radial struts which presumably carry the centre bearing. Further to the rear is the neat combustion chamber, presumably of the annular or can-annular variety, around which are twin fuel galleries for the 13 burners.

Fuel systems suitable for the Junior have been prepared by Lucas, Hobson and Dowty; that fitted to the engine on display is the product of the last-mentioned company—who, incidentally, showed a cutaway exhibit at the 1955 S.B.A.C. exhibition which seems to fit the Gyron Junior admirably. This exhibit was noteworthy for having burners with upstream injection. Moving further to the rear, the next section is occupied by the turbine which, like that of the Gyron Senior, seems to have more than one stage. Around the casing is bolted a pair of strong ring members providing multiple engine-mounting points on their periphery. The exhaust end of the engine is a typical polished-steel assembly, leading to a jet pipe with a diameter almost as great as that of the engine intake.

Into this trim unit has been built all the experience of several years' intensive investigation into the optimum type of turbojet for flight at high supersonic Mach numbers. de Havilland state that "the availability of a family of engines to the de Havilland high-supersonic formula offers a range of power and versatility of installation to satisfy the designer of the future generation of high-velocity stratospheric interceptors as well as tactical aircraft for army close support. These engines come near to the optimum in gas-turbine efficiency and fuel economy at high supersonic speed at altitude, and for that reason they also have a valuable application in large, supersonic, long-range aircraft. Low specific weight and small frontal area are particular features of the Gyron Junior, and are especially important in the interceptor case. The de Havilland concept envisages the installation of these special turbines in combination with controllable liquid-propellant rocket engines, on which the Engine Company has long been engaged. The rocket engine, unaffected by the decreasing density of the air at height, serves to maintain rate of climb in the stratosphere and makes possible the rapid acceleration to high supersonic speeds at the top of the climb, as well as providing ample power for manœuvrability at such heights. The Spectre, not as yet shown in public, is an example of de Havilland rocket development."

STILL-BETTER BIG TURBOJETS

FOUR years ago we had just announced the existence of a new family of redesigned Rolls-Royce Avons and of a wholly new split-compressor turbojet named the Bristol Olympus. Since that time both engines have progressed tremendously and have kept their respective manufacturers in the forefront of the large-jet picture. We are now able to announce yet further refinements in these great families.

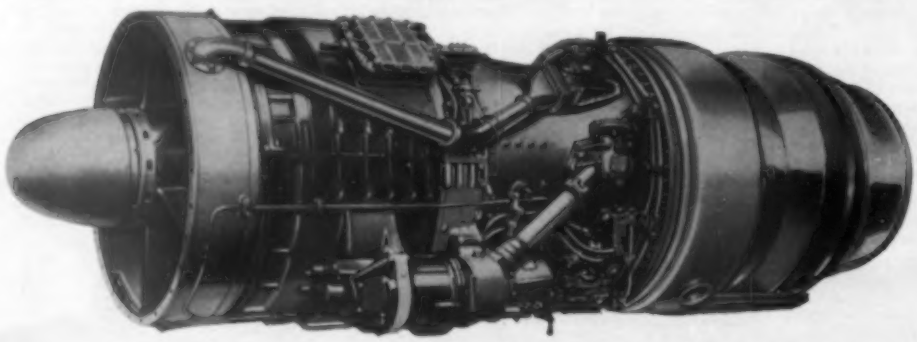
Within limits, anybody can extract more thrust from a turbojet merely by allowing the turbine-inlet temperature to rise. This, however, raises the specific fuel consumption and both Rolls-Royce and Bristol have been most anxious not only to achieve minimum consumption, but also to keep the rise in top temperature strictly in check.

One of these new engines is the Rolls-Royce Avon RA.29. Its existence has been known for some months, but all details relating to it have until now been withheld. Basically the RA.29 is typical of the other units in the 200-series family of Avons but, whereas the newest military engines have gone on getting hotter and hotter (with an eye on high thrust and supersonic flight conditions), the commercial RA.29 is designed to operate under conditions of remarkably cool top temperature in order to obtain the best possible specific fuel consumption. In comparison with its predecessors, the RA.29 has additional compressor and turbine stages enabling it to pass a greater mass flow at an increased pressure ratio. It has thus been possible to establish the rated thrust of 10,500 lb while retaining conditions of operation which are so easy-going as to assure a rapid build up to an exceptionally long overhaul period.

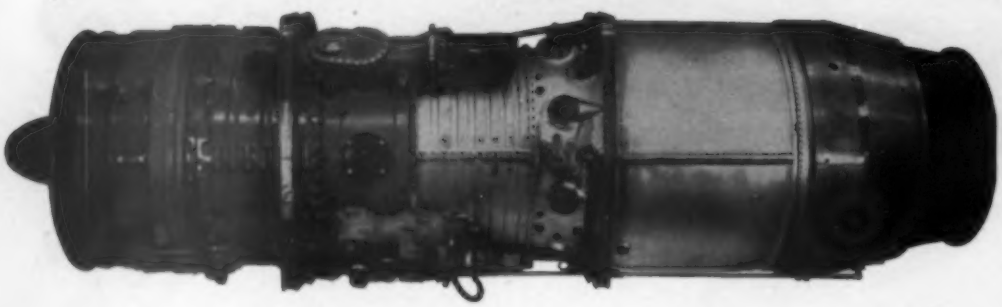
An accompanying photograph illustrates a typical RA.29 with bleed manifolds around the combustion chamber, a kinked hot-air pipe to de-ice the front end and a mechanical drive to accessories on the lower port side. This week an example of the engine is being flown at Farnborough in a Canberra, as described on a later page. Further reference to the RA.29 programme was contained in a lengthy article in our issue of August 17.

The other new big turbojet is the Olympus BOl.6. A full account of the basic design of the Olympus was given in our issue of December 9 last and a considerable number of the 100-series Olympus have now been delivered by Bristol Aero Engines for the Avro Vulcan. Although this aircraft is perfectly happy with the 48,000-odd lb of thrust which it can at present call upon at sea level, it has long been apparent that it could utilize more power at top altitude—notwithstanding the Bristol claim that the Olympus delivers more power in the stratosphere than any other turbojet.

Accordingly, the basic 100-series engine was completely redesigned to give considerably higher thrust while losing nothing in the way of the very competitive specific consumption characteristic of all Olympus engines. That Bristol have obtained a



The Rolls-Royce Avon RA. 29 commercial transport engine has a lower specific fuel consumption than has been announced for any other single-shaft turbojet; at sea level, maximum thrust, the figure is 0.775. Other data are: diameter, 42in; length, 124.8in; dry weight, 3,341 lb; and maximum thrust 10,500 lb.



Data pertaining to the Bristol Olympus BOl.6, the highest-thrust turbojet yet announced by any country, are: diameter, 40.875in; overall length, 152.34in; and maximum static sea-level thrust, 16,000 lb.

GETTING THINGS DONE

These days it goes without saying that an aircraft plant must be well equipped to stay in business. The competitive nature of the industry as well as the complexity of the finished product make first-rate plant facilities an essential factor in its success. Where companies do differ is in the *way* their equipment is used—how they get on with the job—the planning and thinking they do before the wheels are turned.

At Canadair such thinking is reflected in rigid cost control, production planning, schedule controlling, engineering imagination, standards set for close tolerance work and, of course, the broad band of supervision which, from top to bottom of the organization, "gets things done".

Perhaps that is why, aside from having the latest production equipment, we can handle simultaneously such a diversity of contracts . . . Sabre jet fighters, airliners, jet training planes, guided missiles, nuclear research and the largest aircraft ever to be manufactured in Canada—the Canadair CL-28 maritime reconnaissance aircraft.

CANADAIR
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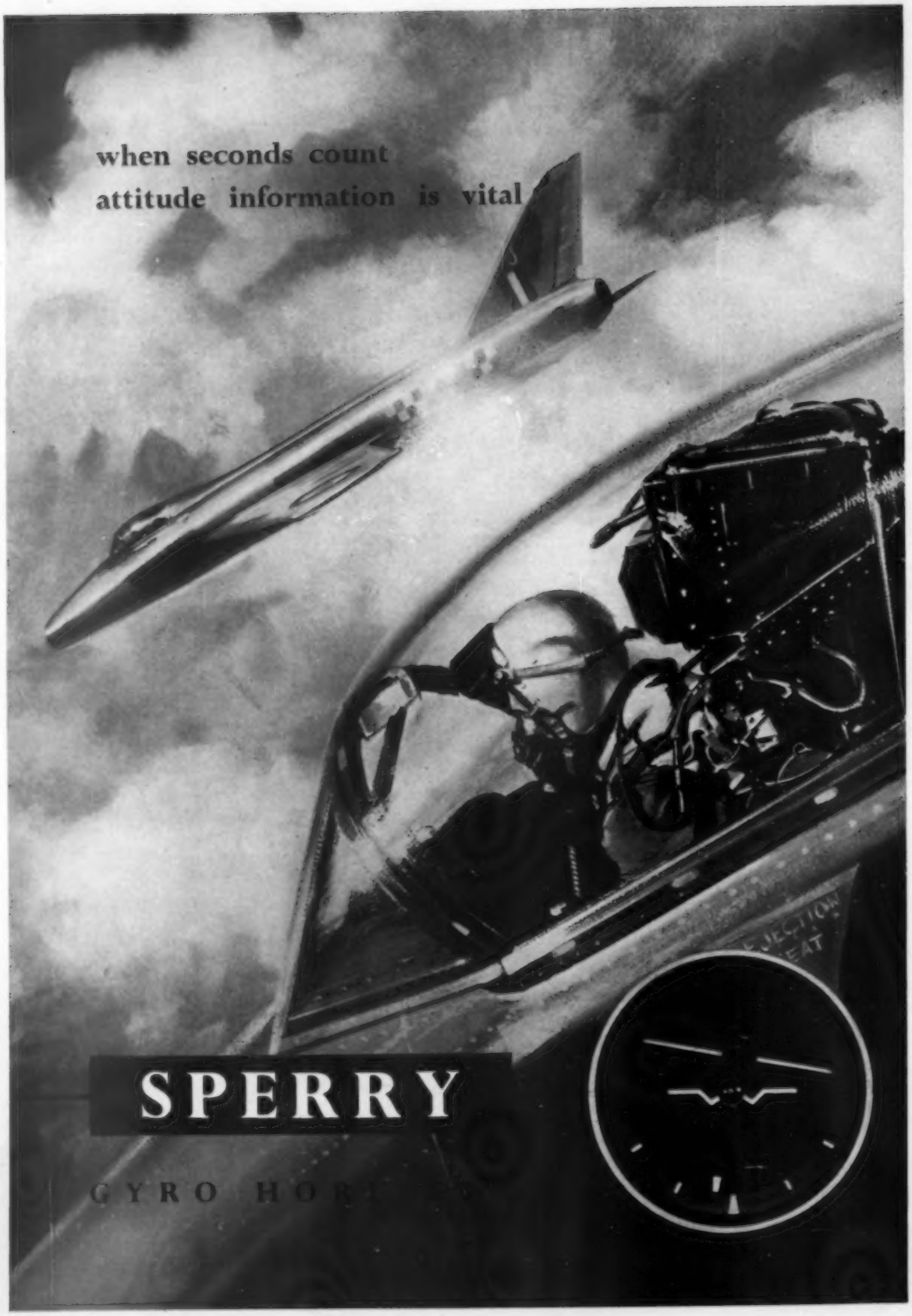
AIRCRAFT MANUFACTURERS

European Representative: J. H. Davis, Princes House, 190 Piccadilly, London W 1., England

CANADAIR HAS PRODUCED MORE JET AIRCRAFT THAN ANY OTHER CANADIAN MANUFACTURER


when seconds count
attitude information is vital
SPERRY
GYRO HOR

STILL-BETTER BIG TURBOJETS . . .

very great increase in thrust while actually improving these specifics is a most commendable achievement.

It is apparent that the BOl.6 family of engines have a longer compressor with a bigger intake diameter, which substantiates the self-evident contention that the mass flow and pressure ratio have both been appreciably increased. The redesign is actually quite extensive, although it has taken the form of refinement rather than a change in policy. By this means not only have all the good qualities of the earlier Olympus been retained, but it has been possible to evolve the up-rated engine very quickly. The first prototype was run on the bed at Patchway towards the end of 1954, and the announced thrust of 16,000 lb has already been substantially exceeded in recent months.

It is likely that, had the programme not been discontinued, the thin-wing Javelin development would have been powered by a pair of engines in the BOl.6 class. There are other possible applications (apart from the Vulcan), but no details may be given of these. It would also be a comparatively simple matter to make available a commercial derivative of the BOl.6, with characteristics ideally suited to the largest types of American jet transport. Visitors to Farnborough this year can see the BOl.6 on the Bristol company stand.

TOP-DRAWER TOP-DRESSER

THE first production model of the Edgar Percival E.P.9, which made its first flight as recently as Monday, August 27, was due to be shipped to New Zealand last Monday. The buyers are the Manawatu Aerial Topdressing Company, Ltd., of Palmerston North, who will use the machine as a demonstrator as well as for their normal phosphate-spreading business. This aircraft varies from the prototype only in minor details, such as the inclusion of a one-piece, starboard-hinged loading door, and revised tail-wheel suspension, and it will arrive in New Zealand in time to be shown at the international agricultural aviation exhibition which is being held during the seventh International Grassland Congress in November. At present the Manawatu company operate Cessna 180s, but they consider that superior loading-carrying ability should give the E.P.9 an advantage on short-range work. In top-dressing terms this means under three miles from the take-off strip.

"Flight" photograph

Prototype and production model: The two P.9s demonstrated at Stapleford Tawney.

Top-dressing in New Zealand, as emphasized on previous occasions in *Flight*, is big business, and accounts for more hours flown annually than the local airlines and flying clubs combined. Last year, 84,787 hours were flown and 405,000 tons of super phosphate, lime and basic slag were dropped, in addition to nearly 400,000 gallons of weed and crop-sprays. Assuming a utilization of about 800 hr per year, some measure of the aircraft capacity required can be gained. This capacity has recently been increasingly filled by American aircraft, as the Tiger Moth is now considered by farmers to be obsolete and uneconomic for this operation.

The attraction of the E.P.9 extends beyond its applications as a top-dresser and crop-sprayer, since it is well suited for use as a light freighter and can also be used to carry two stretchers, an attendant and a walking case. The low loading platform and cargo space of 185 cu ft allow the transportation of small animals, and one particular enquiry has been received for the aircraft with a view to the carrying of prize rams. A considerable number of order enquiries have been made in the very short time that the E.P.9 has been in existence, and eight firm orders have already been placed—from North and Western Australia, Queensland, Tasmania, the Belgian Congo (for locust and tsetse control and cotton, coffee and cocoa spraying), Hong Kong, and the Argentine, where the Deutsch company will use the aircraft for transporting small diesels. Capt. Percival anticipates that 17 or 18 aircraft should be completed by the end of the year, and production of 150 machines is planned for 1957. In the small factory at Stapleford Tawney in Essex, the third machine is now under construction and the framework of seven fuselages (which are constructed from welded T.45 tube) are complete. A high quality in construction and finish of the components is much in evidence. It is understood from Capt. Percival that the C. of A. negotiations are mainly cleared and that the certificate is now "in the paperwork stage."

Among the specialized problems that have to be tackled in the design of an agricultural aircraft are those of easy and rapid conversion to suit different rôles, and of combating the corrosive effects on the aircraft structure of the chemicals carried, particularly when they become wet. The E.P.9 can be adapted to take any of the popular current designs of spray equipment, and the hopper can be removed in less than half-an-hour. Corrosion protection has been tackled by the use of suitable materials—the welded steel fuselage frame and fabric covering—and the rudder and elevator control wires passing down the fuselage are deliberately left exposed so that they can be easily inspected and brushed clean.

At a demonstration before the first production aircraft ZB-BDP left for New Zealand, *Flight* took the opportunity of sampling the prototype machine in company with its designer. Access to the cockpit is *via* the Goodyear wheel and a small step between the divided undercarriage legs, and requires some degree of agility. A high-wing layout has been chosen in order to improve the visibility when taxying over broken ground, and the high position of the cockpit and flat-six engine gives the pilot an excellent view forward and to each side. The aircraft is fitted with a primer and starter so that after a cockpit check (the run-up had been done previously) which included selecting flap from a lever between the seats, the central brake lever was released, the aircraft pointed down-field and flown off. In spite of being out of wind, the take-off run was remarkably short and the rate and angle of climb very high. At cruising altitude the E.P.9 was trimmed—by several turns of the roof-mounted trim lever with a visual indicator—to a tail-well-up attitude that gave a quite remarkable view over the sloping nose. Impressions gained during this necessarily brief trip were that the aircraft is smooth, acceptably quiet and stable. Earlier, Capt. Percival, flying alone, had shown-off the aircraft in some very sprightly tight turns. The siting of the windows avoids any hampered visibility usual with a high wing. Slow-speed characteristics are most important in an aircraft of this type and E.P.9's pilot demonstrated that it can be flown quite comfortably with the flaps and ailerons drooping and a little power on at well under 40 m.p.h. I.A.S. Even at this speed, a stall—which is quite straight-forward, and from which recovery can be made with very little loss in height—requires that the control column be pulled fully back. The approach is made at about 50 m.p.h. when the attitude, from the air at least, appears to be fairly steep. The round-out came as a surprise, for what seemed certain to be a "wheeler" (from the impression gained of the approach attitude) turned out to be an excellent landing on all three points, and the roll had ceased almost before it could be appreciated that the aircraft was again on the ground.

Flight trials with the prototype have enabled the performance figures reproduced below to be established. In nearly every aspect the new figures represent an improvement over the predicted ones published in a complete description of the E.P.9 in *Flight* of December 30 last year.

EDGAR PERCIVAL E.P.9 (LYCOMING GO-480-B)

Span, 43ft 6in; length, 29ft 6in; height, 8ft 9in; wing area, 227.6 sq ft; fuel capacity, 56 Imp. gal; endurance, 4.75 hr; range, 575 st. miles.

	Normal category	Agricultural category
Power	270 h.p.	270 h.p.
Gross weight	3,415 lb	3,980 lb
Empty weight	1,850 lb	1,900 lb
Useful load	1,565 lb	2,080 lb
Top speed (sea level)	146 m.p.h.	144 m.p.h.
Cruising speed (sea level)	128 m.p.h.	126 m.p.h.
Landing speed (light)	37 m.p.h.	37 m.p.h.
Rate of climb (sea level)	1,140ft/min	990ft/min
Take-off (5 m.p.h. wind)	105 yd	115 yd

HERE AND THERE

MIGS AWAY: Taken at the occasion of the departure from Eastern Germany of the 221st Air Division, Soviet Air Force—also depicted on page 463—these photographs show a Mig-15 fighter and (above) a tandem-seat trainer. The fighter has a new pattern of under-wing tank with a "waisted" section adjacent to the wing.

Carrier Group for Pacific Test

THE air group of the carrier *Warrior*, now undergoing a major refit at Devonport, is to take part in the British hydrogen-bomb test off Christmas Island in the Pacific next year. The Admiralty has not yet disclosed the nature of the group's task.

CF-100s for Europe

DURING a recent tour of R.C.A.F. bases in France, Mr. Ralph Campney, Canadian Minister of National Defence, said that next autumn 30 per cent of the Sabres with which Canadian squadrons in Europe were now equipped would be replaced by CF-100s.

Fireflash Accident

THREE employees of the Fairey Aviation Co., Ltd., were seriously injured last week when an explosion occurred in the booster motors of a Fireflash missile which was being tested in a laboratory at Valley R.A.F. Station, Anglesey. They were engaged on development work for the M.o.S. guided weapons trial establishment at Aberporth.

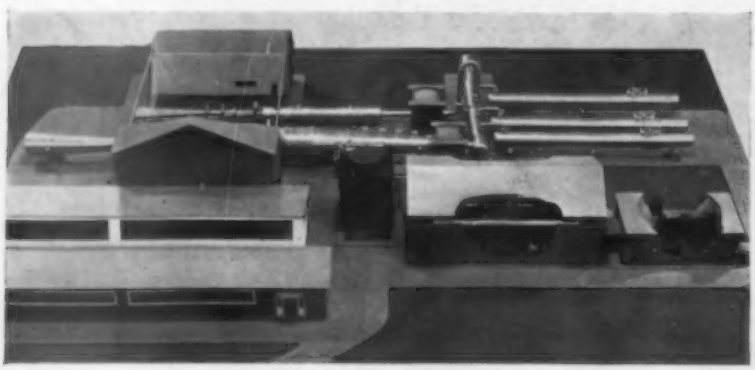
Coach Makers' Officers

THE Company of Coach and Coach Harness Makers—one of the ancient City companies, in which modern transport is represented by members of the aircraft, motor and other industries—has elected the following officers for the ensuing year: Master, Col. Lord Kenilworth, C.B.E., T.D., D.L.; Senior Warden, Mr. R. J. D. Smith; Renter Warden, Mr. Victor Riley; Junior Warden, Mr. Denis Berry, T.D.

Warton Wind Tunnels

ON this page is illustrated a model of the new wind tunnels to be shared between the aircraft and guided weapons division of English Electric at Warton. The three tubes seen in the right background form the storage reservoir for the compressed air which will drive the tunnels. The Mach 6 tunnel is to the left of the reservoir, with the Mach 4 tunnel just in front of it and partly obscured by the wall of the tunnel room. The black structure in the centre of the picture is the heat-exchanger and the building to the left of this is the compressor room. In a brief reference to the project last week we stated that Mr. F. E. Roe was the engineer in charge of the Warton research establishment. He is actually responsible for the Warton wind tunnels; the establishment as a whole comes under the direction of Mr. F. W. Page, chief engineer of the aircraft division.

HIGH-SPEED FACILITY: A model of the English Electric wind tunnels referred to above.



M.T.C.A. Adviser

AS from October 1, Air Marshal Sir Charles Guest is to take up an appointment as additional aeronautical adviser to the Minister of Transport and Civil Aviation. Sir Charles recently retired from the post of Inspector-General of the R.A.F.

Opening Speaker

THE veteran airline pilot Captain O. P. Jones, O.B.E., M.V.O. (he is now B.O.A.C.'s special liaison officer), will be guest speaker at the Aircraft Recognition Society's first meeting of the 1956-57 season, due to take place in the library of the Royal Aeronautical Society, 4 Hamilton Place, London, W.1, on Wednesday, September 19, at 7 p.m. The Society invites all who are interested to attend.

Chocolate Cigar

ACCORDING to a West German Radio report, the first airship to be built in Germany since the war is due to be completed in about two months' time. Seventy-five metres (246ft) long, it will be used by a chocolate firm for advertising.

Aircraft Industry Review

THE *Stock Exchange Gazette* has published as a supplement to its August 31 issue a review of the British aircraft industry, with particular reference to investment prospects. It contains a valuable summary of developments so far, an assessment of the future, and an authoritative appraisal of each of the thirteen member-companies of the S.B.A.C. in which there is a direct public investment interest.

Viscount Honour

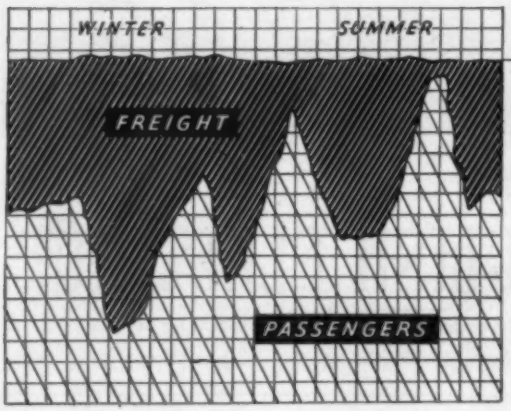
AT Denver, Colorado, on September 10, Mr. T. Gammon, general manager and a director of Vickers-Armstrongs (Aircraft), Ltd., is due to receive one of the Daniels and Fisher creativity awards for 1956. These awards were established by the Denver trading firm of that name to give recognition to "outstanding creative achievement" in the fields of arts, science and industry. The achievement in this case is the Viscount.

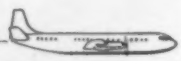
Enlargement and Projection

THE September 12 special issue of our associated journal the *Amateur Photographer* will contain a guide to the enlargers, and projectors for colour transparencies and monochrome slides, that are currently available. Essential accessories, such as masking frames and lenses for enlargers, and screens for projectors, are also described, thus enabling the amateur who wishes to make the most of his holiday negatives or to view his holiday colour pictures in the best way, to choose equipment suitable for his needs.

A winter night . . . passenger traffic at its lowest ebb . . . but full payload will be achieved with the Vickers Vanguard, at any season of the year, and at any time of day. In off-seasons, when passenger bookings diminish to a trickle, freight can be increased up to a maximum of 21,000 lb. The balance of freight and passengers can be continuously adjusted, without structural conversion, to meet any density of traffic, and still give profitable operation.

WINGS DAY SEPT. 15th GIVE FOR THOSE WHO GAVE





Peak period is all day long—all year round, with the

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE PROPELLER-TURBINE ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

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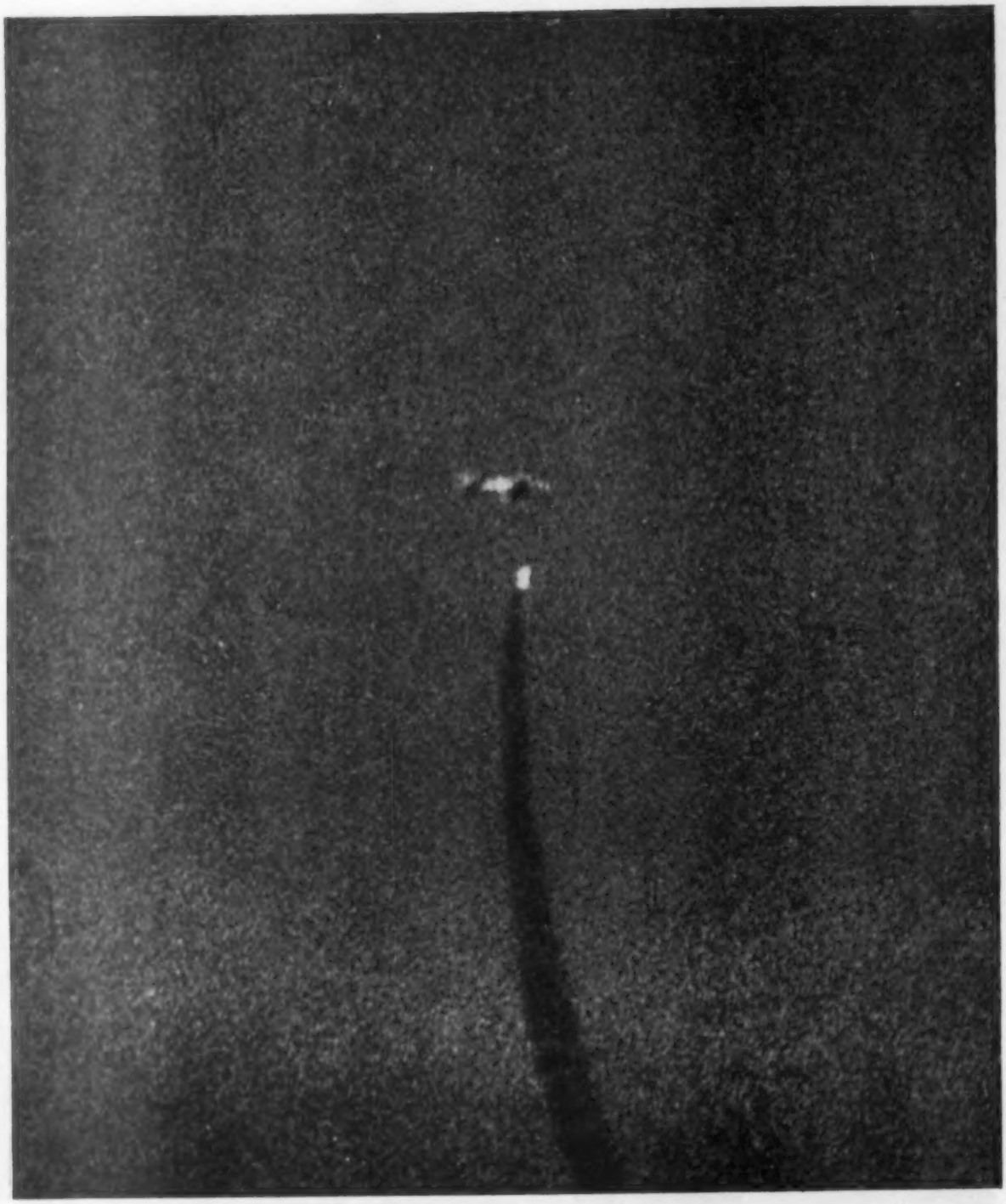


GUIDED WEAPONS by

'ENGLISH ELECTRIC'

ENGLISH ELECTRIC · MARCONI · NAPIER

R.A.F. BENEVOLENT FUND 67 PORTLAND PLACE LONDON, W.1.

THE SEVENTEENTH S.B.A.C. DISPLAY

Another Opening in "Per Ardua" Style

Illustrated mainly with "Flight" photographs

IT was too much to hope, of course, that the spring-like early morning of Monday, September 3, would bring forth one of those flawless dreamed-of Farnborough days. By eleven the clouds had ganged up like Teddy boys, all set for no good; and abetting them was a cold-blooded, loutish wind.

The voice of Oliver Stewart cheered us measurably when it came on the air at 1410 hr to remind us that the flying then imminent was a full rehearsal for next day's official opening. Timing and the direction of control were, as usual, in the practised hands of Mr. Pearson and his staff; and Mr. Hall, the met. officer, had given notice of a 15 kt wind, gusting up to 20-25 kt across the main runway. Cloud-base was 2,500ft; surface visibility ten miles; and contrails were unlikely except in a thin layer at 31,000ft (a wholly academic item of information as things turned out).

First machine away—the Beverley—got rolling on the second of 1430 hr and, except when low cloud supervened, as it did for much of the time, things went pretty much to plan. The two Britannias and the Shackleton M.R.3 left noticeable gaps in the programme and in the aircraft park alike, though the Britannia 301 came in to grace the scene at the end of the day's flying. As the first of the fighters took its cue the rain came down in dismal earnest, and the waterlogged air afforded the all-too-familiar study in combined aero- and hydro-dynamics.

The honours of Monday must go—for reasons that we detail on a later page—to the Westland helicopter team (to Roy Bradley in particular); to the Canberra P.R.9; the two Javelins; and the Hunter *corps de ballet*. But by the time this is read the laurels may have been distributed otherwise.

Is it too much to hope that on at least one of the seven flying days the Fairey partnership of champions—Peter Twiss and Gordon Slade—will be enabled (as they had been on the Sunday) to set their F.D.2s head-on at each other and scorch the wide blue at 2,400 m.p.h. closing speed, sending down titanic booms through miles of space?

In the pattern and arrangement of this year's display, there are few significant changes compared with that of 1955. Once more the general emphasis is on production aircraft rather than prototypes while, in the air and in the exhibition tent, the veil of security has been lifted to provide a brief glimpse of development in the field of guided weapons.

The flying display is opened this year with a special curtain-raiser. This comprises the various flying test beds (four new engines are being demonstrated) plus the sight of a Beverley in action and a Hunter reversing its Avon's thrust. R.A.F. participation, which appears on each day of Farnborough week except Thursday, is in the talented hands of two formation teams—the Hunters of 43 Squadron led by F/L. Peter Bairsto; and the Canberras of 231 O.C.U. led by S/L. F. P. Walker, A.F.C., who made their public debut in striking fashion at the recent Coventry air race meeting. In between the two formation displays comes the

Speeding on its way to Farnborough is WG 774, the original Fairey F.D.2 with which Peter Twiss set a new World Speed Record.

THE SEVENTEENTH S.B.A.C. DISPLAY . . .

helicopter circus, with contributions by Bristol, Saunders-Roe, Westland and Fairey.

The one-hour main display follows. One of the chief attractions on the programme is the appearance of the two Fairey F.D.2 research aircraft, which can also be inspected on the ground prior to the flying. A disappointing late cancellation was the English Electric P.1, which was to have made a fleeting visit. New this year are the Javelin T.3, Supermarine N.113, Swift Mk 7, Britannia 301 and the Viscount 802, while officially new this year is the permission with which invited guests can fly in the Herald, Twin Pioneer and President.

This year's display regulations forbid supersonic flying below 30,000ft—on M.T.C.A. and M.o.S. instructions, according to the director of the S.B.A.C. Last year, the Society states, there was no such regulation, but no company chose to include supersonic flying in the demonstrations of its aircraft.

Following an amount of bulldozing and rearrangement of the slopes in front of the exhibition tent, the exhibitors' enclosures, *alias* caravan sites, are located in terraced rows. In the tent itself, of 113,000 sq ft, a record number of 338 exhibitors are housed, some of whom (such as English Electric, G.E.C., Avro, Plessey, Bristol and I.C.I.) have on view guided-weapon components. Last year's innovation of a separate outdoor exhibition annexe, for large pieces of equipment and other exhibits, is repeated this year.

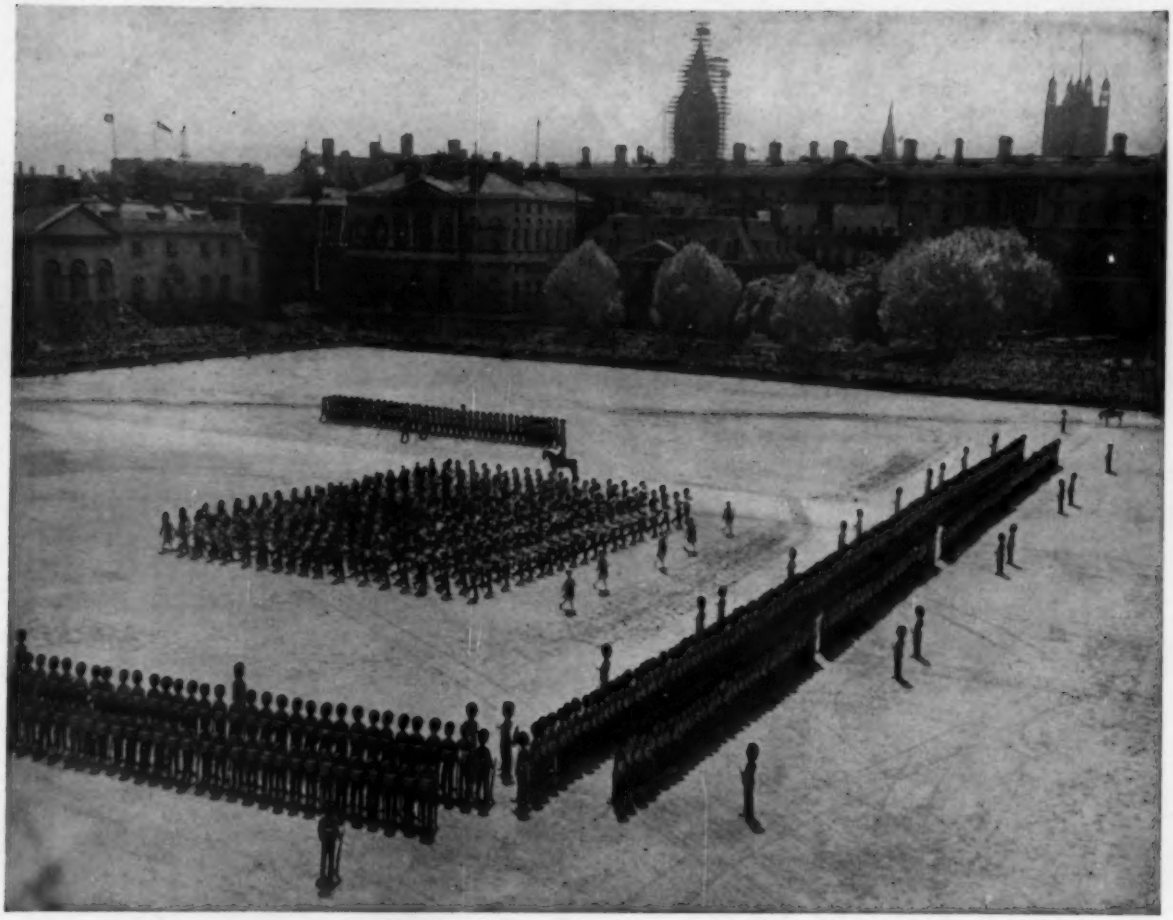
Year after year the number of official guests attending the exhibition and display increases, the total number of invitations sent out (home and overseas) being about 48,000. Last year the number of overseas guests attending was 6,000; this year it is over 6,500, from a total of 120 countries, and with a higher general level of representation than ever before. Two delegations from the Soviet Union have been invited this year, and are attending; one representing the Services (and led by the Chief of the Soviet Air Staff) and the other comprising delegates from the Soviet Ministry of Aircraft Production. This is the first time since 1947 that official Russian representatives have been invited to the S.B.A.C. show.

As in previous years, the French contingent of official visitors is the largest, with the United States (the largest and highest-level representation ever) second and Germany (several hundred strong) third. Among the other national delegations are official missions from Argentina, Italy, Turkey and Venezuela.

For the British industry representatives and the general public, arrangements in general follow the pattern of previous years. Plans have been made to cope with the same number of spectators as last year; a significant indication of prospects for the weekend is that the level of advance booking, in spite of this summer's continuous spell of bad weather, is noticeably higher than last year.

Although there are few completely new types appearing at this, the 17th of the S.B.A.C. displays, the selection of aircraft is wide and, as always, sprinkled with surprises in appearance, handling and background detail. The following type-by-type report gives notes on those machines appearing this week at Farnborough; the flying demonstrations described are those of Monday, September 3.

Emulating a mixed-power interceptor, Mike Randrup turns the Napier Canberra smartly, with a row of shock-diamonds—just visible under the rear fuselage—emanating from the Scorpion rocket.



The 800 soldiers in this parade, with their fighting equipment, are a normal load for one squadron of

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The Seventeenth S.B.A.C. Display

THE AIRCRAFT

Auster Agricola. Attracting great interest on the Auster stand inside the exhibition tent is the third production Agricola top-dressing aircraft, complete with hopper and carrying the New Zealand registration ZK-BMK. The Agricola is barred from participating in the flying display as it is powered by a foreign engine (240 h.p. Continental).

Auster Aiglet Trainer. Auster's J5L Aiglet Trainer demonstrator G-ANXC appeared at Farnborough on Monday morning, having been delayed by bad weather at Rearsby. Powered by a 145 h.p. Gipsy Major 10, the red-and-white machine is flown with customary polish by Ranald Porteous during the afternoon display. His demonstration includes two Porteous avalanches, and loops, stall turns and climbing rolls.

Armstrong Whitworth Sea Hawk FGA.6 (XE 456). After steady development the Sea Hawk is now becoming predominantly a ground-attack aircraft. In this rôle the FGA.6 is the latest variant, benefiting principally from an up-rated Rolls-Royce Nene and a greater complement of stores-carrying pylons. The aircraft at Farnborough is flying with two 75-gal asbestos-phenolic tanks, with flat tailfins, mounted on the inner pylons which attach just inboard of the wing fold. Two further pylons, outboard of the fold, each carry, in this particular case, a Mk 1 medium-case 500-lb bomb. Outboard of these again are, to starboard, two tiers of two concrete-headed, 60-lb air-to-ground rockets and, to port, two tiers of 3in air-to-ground rockets on Mk 12 launching rails. With this sample load the Sea Hawk has useful aerobatic capability. The four fuselage-mounted 20 mm cannon are retained.

Aviation Traders Accountant. Models of the Dart-powered venture by Aviation Traders into the strongly contended but as yet untapped DC-3-replacement market appear on the company's stand. Two versions are offered: the Mk 1 executive version, and the longer Mk 2 (with nose-cargo door, if required, for freighting) accommodating up to 42 passengers. The prototype is due to fly before the end of the year.

Avro Shackleton M.R.3. Scheduled to appear at Farnborough only until the Thursday of the Show, the machine to be displayed —a production M.R.3—was to return to Woodford to continue a programme of test flying. Production of machines destined for the R.A.F. and South African Air Force is now under way, although deliveries for the latter Service have not yet started.

Avro Vulcan B.1 (XA 892). The production Vulcan shown this year is notably different in plan-form from the second pre-production machine shown twelve months ago. The leading edge of the large delta wing has been modified by increasing the chord-length of the outer panel to reduce the thickness/chord ratio. Part of the very large dielectric cover aft of the radome is now painted grey instead of black. The bomb-sight which these covers obscure is known to be one of the most advanced—and certainly one of the most expensive—ever fitted to a British aircraft. An additional external difference in comparison with models previously seen is the row of vortex generators which serve to reduce flow separation over the ailerons and so improve control, a modification that is not unknown on several other aircraft types displayed. The underside of the fuselage is entirely clean and free from projections, apart from four small scoops under the starboard side of each engine. The aircraft displayed at Farnborough trailed a large braking parachute when landing.

Since Easter several Vulcans have been undergoing Phase 1 trials at the Aircraft and Armament Experimental Establishment at Boscombe Down. When these have been completed, the aircraft will begin to go into squadron service; one station at least is now being equipped to accept production aircraft. A Vulcan is shortly to go to Australia to participate in the R.A.A.F. Commemoration Week ceremonies.

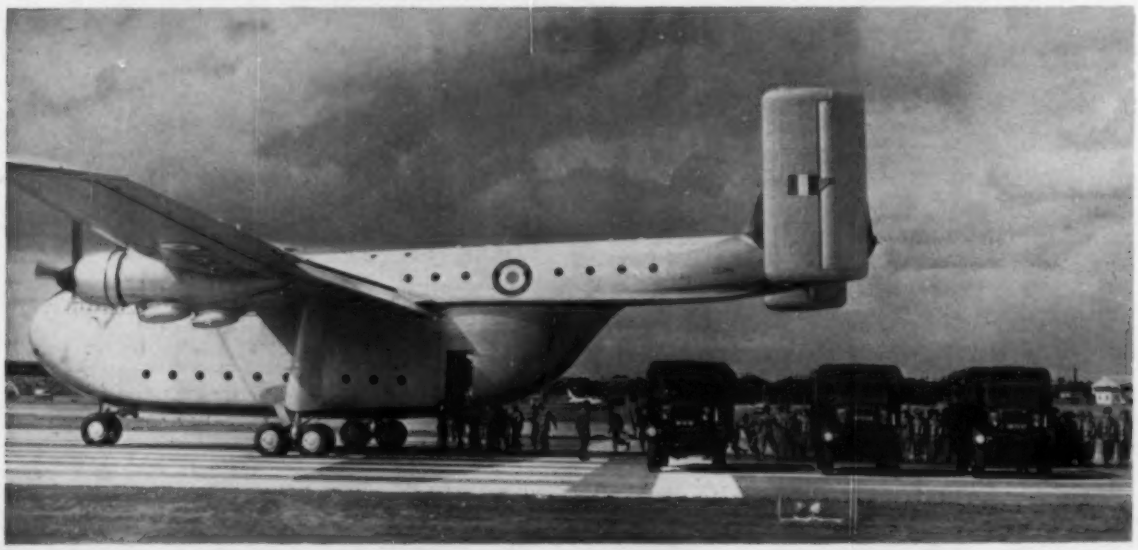
Blackburn Beverley C.1 (XB 289). A striking display of the Beverley's ability to carry large numbers of troops is made when 100 men, all carrying rifles, enter the aircraft through the loading hatch in the port clamshell door in under two minutes. A wide variety of interior configurations and loads are possible, and mixed loads of troops, stretchers, cargo and vehicles can be carried. The seats are of Blackburn design and can be stowed against the fuselage sides when not in use. The machine shown is the eighteenth aircraft to be built and the twelfth to go into service with the R.A.F. No. 47 Squadron, whose C.O. is S/L. D. P. Boulnois, are now operating Beverleys from Abingdon.

The display aircraft is fitted with Dunlop wheels with Maxaret brakes and a notice on the fuselage warns operators to "switch off all radar sets for refuelling and defuelling."

Bristol Britannia. Two significant new representatives of the Britannia's family are to be shown. One, the prototype G-ALBO fitted with a Bristol Orion, is described overleaf. The other, first flown as recently as July 31, is the prototype 301, the forerunner of the new breed of higher powered, larger-capacity Britannia 300-series, variants upon whose short- and medium-range capabilities attention has recently been sharply focussed. The prototype 301, immediately distinguished from its series-100 predecessor by the pleasing proportions imparted by the lengthened (10ft 3in) fuselage, is capable of accommodating 133 passengers. Styled in a crimson-and-white Bristol colour scheme, and registered G-ANCA, it was the twelfth Britannia to fly.

Aerodynamically, this aircraft is truly representative of the forthcoming 310/320 production Britannias, and, being powered by the higher-rated (4,120 e.h.p.) Proteus 755 engines of those aircraft, it is being intensively used as the performance test-vehicle for the new breed. First deliveries of 310s will be made to B.O.A.C., Canadian Pacific Air Lines and El Al Israel Airlines

Curtain-raiser to the 1956 Farnborough flying display was a lively display by the Blackburn Beverley, which swallowed one hundred troops, plus rifles, in under two minutes, gave them a quick circuit and then landed in a matter of three hundred yards.



This year S/L. W. R. Gellatly operated the agile Fairey Ultra-Light helicopter from a company truck. In modified form it is sweet to fly.

THE SEVENTEENTH S.B.A.C. DISPLAY . . .

in the latter half of next year. Emphasis was placed recently upon the Britannia's short- and medium-range capabilities by the announcement of a new variant, the 320. This aircraft, like the 310, will have a cruising speed of slightly more than 400 m.p.h., but, unlike that aircraft—which is essentially a long-ranger—it will have reduced fuel tankage. It is to this version that American operators (see page 423) are paying particular attention at the present time.

The Britannia order book was increased from 55 to 56 on the opening day of the display by an order for one 310, plus an option on two, by the British independent airline Hunting Clan. Next month the first Britannia 102 passenger services are due to be inaugurated by B.O.A.C.

Bristol Orion-Britannia (G-ALBO). This famous aeroplane, the first of all the Britannias and flying since August 1952, has been turned into an engine-development vehicle reminiscent of "Old 1961" at Burbank. From starboard to port the powerplants comprise a Proteus 705, a second 705, a Proteus 755 and an Orion—all, of course, made by Bristol Aero-Engines.

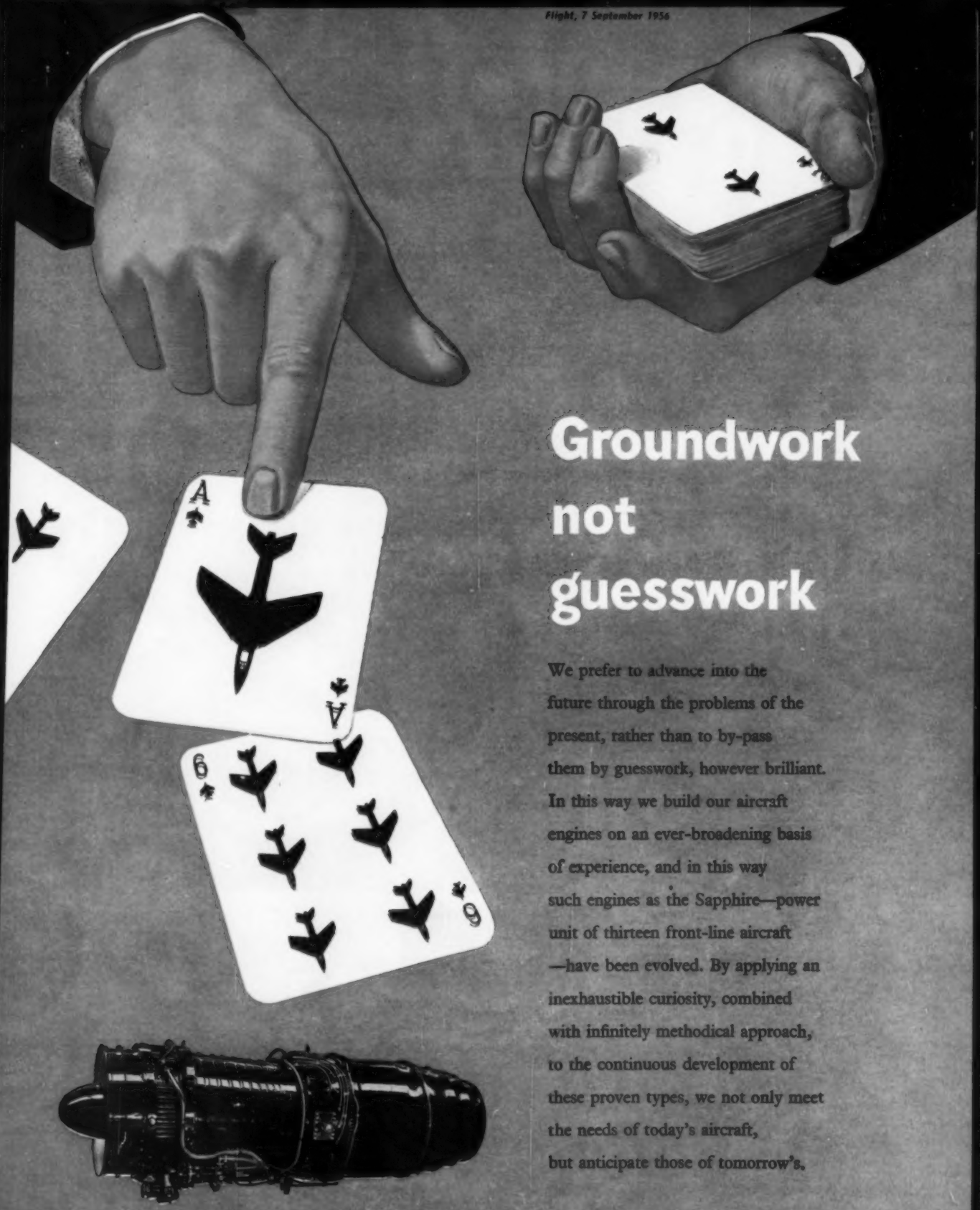
The trim Orion has been penalized by having to fit the fat Proteus nacelle, for it has been carefully engineered so that it can be bolted on to an existing Proteus firewall in the minimum of conversion man-hours. In spite of its great power the Orion installation is actually lighter than that of the Proteus. ALBO first flew on the Friday before the Show, and windmilling trials revealed a lubrication problem, of a minor nature, which recurred on the Saturday and Monday. It was hoped that, following minor alterations to the Orion reduction gear, the aircraft would be able to fly to Farnborough by Tuesday.

Bristol 171 (G-AMWI). Bristol's Sycamore Mk 4 demonstrator this year sports a red-and-white colour scheme, and is seen to carry the Perspex side-blisters which provide the extra cabin width for the stretchers carried in the ambulance version, in addition to the hydraulic winch, starboard-mounted, for search and rescue. On the stretcher mounting inside the fuselage is installed a Pye industrial television camera installation, which has been flight tested in the Sycamore and demonstrated to police authorities and the Army.

Bristol 173 (XH 379). The second prototype of the Bristol 173 Mk 2 appears this year at Farnborough with fixed horizontal and vertical tail surfaces (which, incidentally, were fitted only last Friday) in place of last year's vee-tail. Bearing the insignia of British European Airways (King Arthur Class: *Sir Bors*), this machine has in fact been the subject of intensive handling trials by B.E.A. during recent months. The three small red-knobbed rods which now sprout from each rotor head indicate the addition of new centrifugal droop stops, spring devices which prevent the rotor blades from drooping excessively when stationary. Inside the fuselage are four single forward-facing seats and a twin inward-facing bench seat.

de Havilland Comet (G-ANLO). The heavy programme of experimental work allotted to the Comet 3 prototype has precluded the appearance of the aircraft at this year's display. The machine is at present undergoing extensive modifications at Hatfield to make it fully representative in all essentials—engines, systems and aerodynamics—of the Comet 4 and 4A. This programme, made especially urgent by the recent order for four Comet 4s and ten 4As from Capital Airlines, U.S.A., will enable much of the new Comets' performance and certification flying to be carried out well before completion of No. 1 production Comet 4, which will be the first of B.O.A.C.'s 19, now scheduled for November 1957. Development-hours on the Rolls-Royce Avon RA.29 engines of the 4 and 4A are to be augmented by two Comet 2s, which are now being modified to take a pair each of these 10,500 lb powerplants. (As

Armstrong Whitworth's P. M. R. Walton threw the Sea Hawk FGA.6 all round the sky in spite of its assortment of under-wing stores. Here, however, it is proceeding in more sedate fashion.



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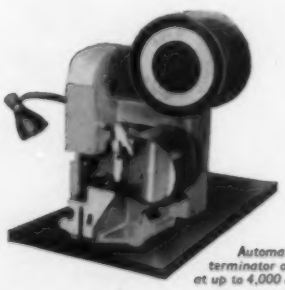

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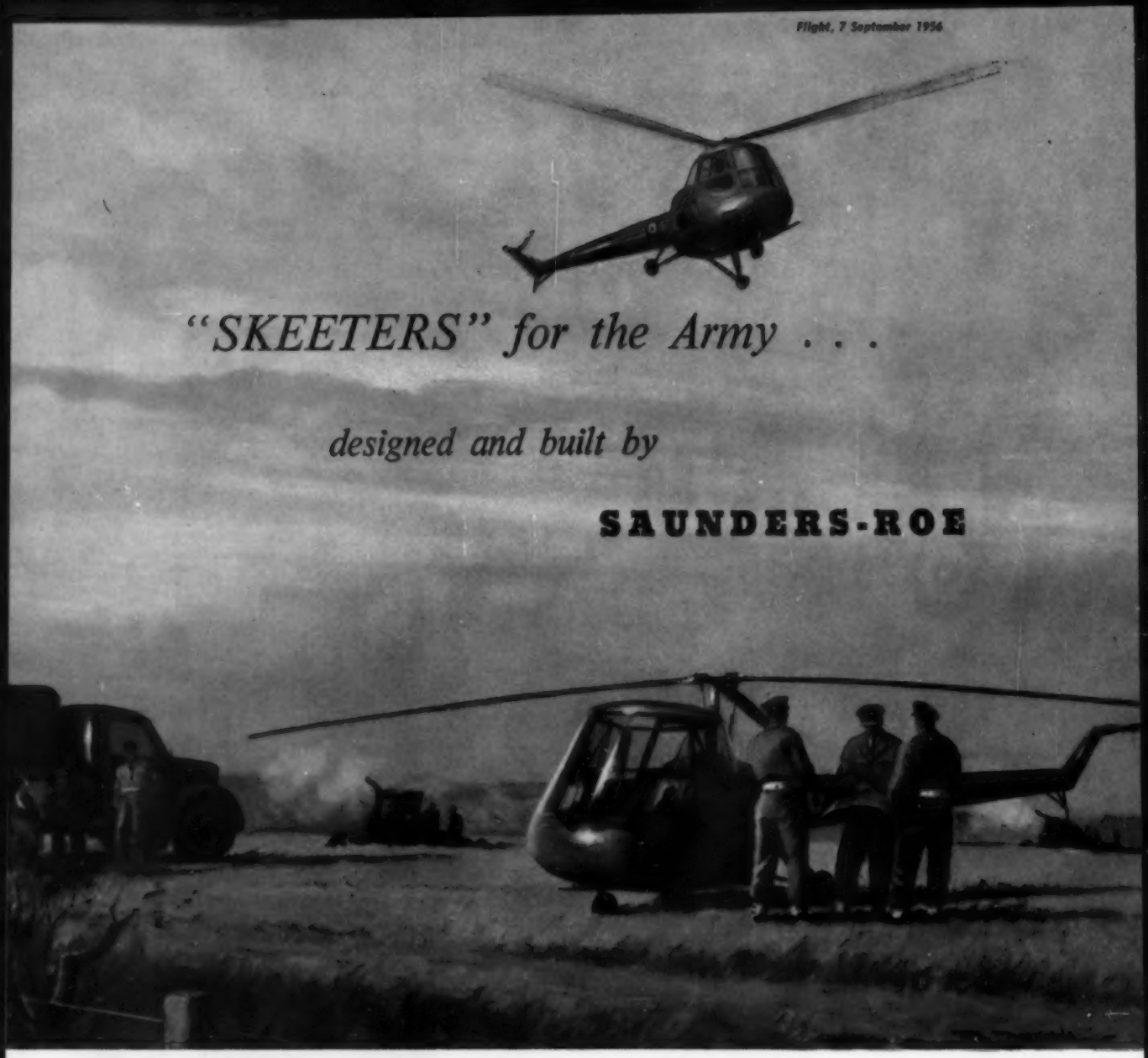

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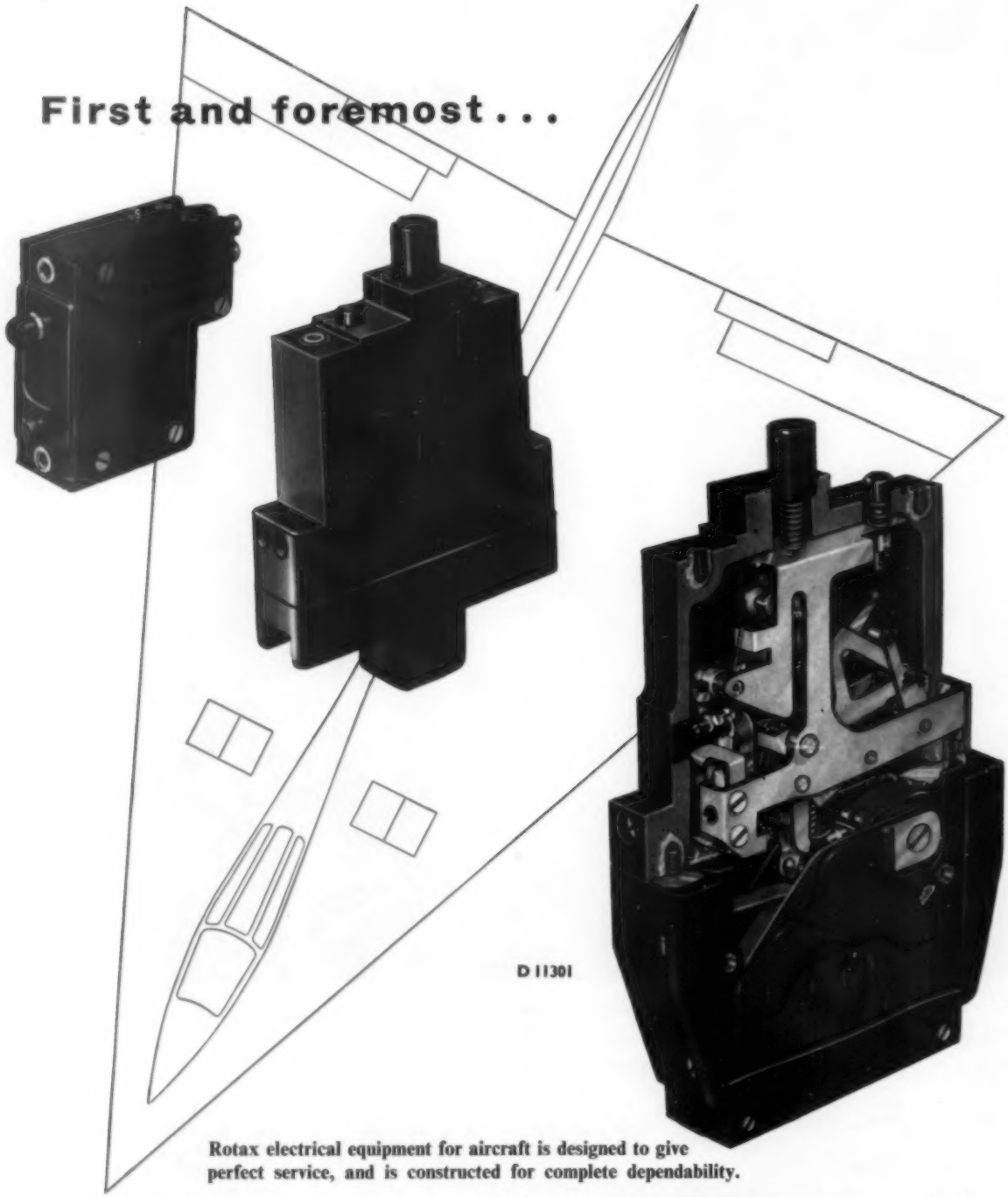

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THE SEVENTEENTH S.B.A.C. DISPLAY . . .

described on another page, development flying of these engines has already been started by the RA.29 Canberra.)

Disappointment at the Comet 3's absence is, however, assuaged by the appearance at this year's display of a Royal Air Force Comet C.2. The particular machine displayed, in the businesslike silver, blue and white colours of Transport Command, bears the serial XK 695. Actually the eighth Comet 2 (No. 06030), it will, immediately after the display, be the fourth to be delivered to No. 216 Squadron at Lyneham.

Close inspection of the aircraft—it is in the static park—reveals considerable structural reinforcement of the pressurized fuselage, in particular a full-length strip incorporating the windows, which are now elliptical instead of square. The nose is a dielectric cap, conforming closely in shape to the original, housing the Ekco collision-warning radar. The interior is arranged for the accommodation of 28 passengers, in full airline luxury (the trimmings are, in fact, to the B.O.A.C. style), including galley. The whole of the floor between cabin and flight deck has been restressed to take freight up to 11,200 lb at floor loads of 120 lb/sq in.

de Havilland D.H.110 (XF 828). Now highly developed, the D.H.110 has undergone important modification since last year. The example at Farnborough is the prototype which completed carrier trials in April. It was built at Christchurch, where full production is now under way. A Mk 20X, it still has provision for four Aden guns, though the troughs ahead of the barrels are covered over. The wings of XF 828 do not yet fold. The base of each fin now has considerable reinforcement and a sprung skid (which shows signs of having been scraped on runways). This will be raised six inches in future.

A large brass fitting close by the radar observer's compartment is a combined dynamic and static pressure-sensing head, electrically de-iced, presumably serving a "feel" device.

A panel under each wing is marked as an Avtur pressure-refuelling point and two similar unmarked panels farther aft indicate additional nozzles. The machine has the new F.A.A. colours, grey-white underneath and dark grey on top.

An orange light on the forward-facing nosewheel door lights up to show the control officer that the hook is extended and wheels down and locked. Large metal strakes running fore and aft along the edge of the "barn-door" airbrake are designed to make the curved panel as effective as a flat panel of the same frontal area. Maxaret brakes are fitted.

de Havilland Dove. Now in its twelfth year of production, and still selling steadily, the Dove appears this year (in the static park) in Series 5 executive form. The aircraft shown is actually D.H.'s own demonstrator, G-AMZN, in a new crimson-and-white paint scheme. A total of 480 Doves have now been built.

de Havilland Heron. One of two Heron 2s for the Iraqi Air Force, a standard 14-seater, is this year's representative of de Havilland's best-selling four-engined light airliner. The second Iraqi aircraft will be furnished to the executive pattern. The aircraft displayed (serial No. 393) bears the traditional green, white, red and black insignia of the I.A.F., which has appeared on D.H. aircraft of various types for 25 years. The aircraft has the new feathering D.H. airscrew—now a feature of nearly all new Herons.

English Electric Canberra P.R. 9 (WH 793). This very-high-altitude photo-reconnaissance Canberra differs from earlier P.R. marks in having more-powerful (200-series) Rolls-Royce Avons, a slightly extended wing span, an increased wing chord inboard of the nacelles, a larger tailplane and—in its eventual production form—an asymmetric nose similar to that of the B(I).8. Perhaps surprisingly, the development of the Mk 9 has raised several major problems, but these are now solved and deliveries of service-cleared aircraft—from Short and Harland at Belfast—will soon begin.

The machine at Farnborough is the original prototype, distinguished this year by several superficially evident changes, including still-further-extended span and inner-wing chord and the addition of a row of 33 "turbulators" along the upper surface of each wing, together with larger vortex generators on the empennage. A particularly interesting feature is the manner in which the rear (extended) part of the inner wing is cantilevered from the rear spar by chordwise gaps.

English Electric P.1. Due to unforeseen circumstances neither of the two P.1As at present flying is at Farnborough, but a model is exhibited on the English Electric stand. This gave no indication of armament or internal layout, though one of the P.1As has fired its guns at supersonic speeds at various heights. Work is now progressing on the construction of the 20 pre-production P.1Bs.

Fairey F.D.2 (WG 774 and 777). This year, for the first time, both the supersonic research deltas are at Farnborough, and Fairey have worked out the impressive demonstration described on page 456. On Sunday both took off for a practice run, Peter Twiss (holder of the world speed record at 1,132 m.p.h.) flying

Three single-seat Hunters superbly flown by Hawker pilots; from the top: the Mk 6 with tanks and rockets; the converted Mk 4 with Fireflash missiles; and the Mk 6 with four 100-gal tanks.

the record-breaking WG 774 and his chief, G/C. Gordon Slade, flying 777.

About ten minutes after take-off two groups of sonic booms were heard on the airfield, although the presence of six-eighths cloud made it impossible to see anything of the speeding contrails. Returning, both machines delighted in giving a brief exhibition of their flashing performance with afterburner—although, as Twiss told us, the essence of the demonstration was that the sky had to be clear so that the contrail-height display should be seen as well as heard.

On touch-down G/C. Slade's machine was unlucky enough to burst its port tyre. The Fairey chief test pilot did well to keep the fast-moving, narrow-tracked delta running straight and true.

Fairey Firefly U.9 (WB 257). Unlike the Firefly U.8, which was the final mark to be built (the last machine was delivered from Stockport earlier this year) the U (unmanned) Mk 9 is a radio-controlled conversion of the original two-seat Mk 5. With the U.8 it is (say Fairey) the only type of target aircraft to be used in this country for all forms of guided-weapon trials; both were developed in collaboration with the R.A.E.

The machine on view (but not flying) was the first U.9, and it first flew on April 6 of this year. The Mk 5s are first ferried to Fairey's Hamble works, where they are stripped of unessential equipment. Then the Stockport plant takes over and carries out structural modification, installation of the autopilot, "black boxes" and the Stockport-designed wing-tip pods each holding five cameras for recording the proximity of missile bursts. Finally the U.9s are painted in the scarlet-and-cream finish specified for pilotless targets and test-flown (with a pilot).

Fairey Gannet A.S.4 (XA 462). Assumed to have a more powerful version of the Armstrong Siddeley Double-Mamba turboprop engine, the A.S.4 is externally identical with the earlier AS.1. The first prototype A.S. Mk 4, made its initial flight during March 1956. Two production machines, XA 462 and XA 425, are being exhibited. The former—armed with eight red-painted rocket projectiles with high-explosive heads and eight yellow-painted projectiles with tracer heads, a rotary sonobuoy dispenser under the port wing, an air-sea rescue pack under the starboard wing, 1,000 lb mine in the bomb bay and sonobuoys in the bomb doors themselves—is taking part in the flying display.

An even more impressive array of stores surrounds the A.S.4 in the static park. A two-ton load may be selected from eight practice bombs, 10 sonobuoys, 16 rocket projectiles, two air/sea rescue packs, six depth charges, two rotary sonobuoy dispensers, four 500-lb mines, two 1,000-lb mines or one 2,000-lb mine.

Fairey Ultra-Light Helicopter. Of the four Fairey Ultra-Light helicopters that have been built, G-AOUK (the fourth machine),

Described in the text below is the Gloster Javelin T.3 dual-control trainer. It first flew on August 20.

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which is seen at Farnborough this year, now incorporates hydraulic cyclic-pitch controls. This modification, together with a redesigned, flexibly mounted rotor pylon, has made the Ultra-Light an exceptionally sweet helicopter to fly, as was well demonstrated by S/L. Gellatly. After rising vertically—from a lorry—to 1,000ft at an extremely high rate, the machine gave an agile display before dropping into a fast descent which was caught, with a gasp from the crowd, within feet of the ground. One vertical fin and a horizontal tailplane are fitted to G-AOUK; a development project in hand at present is directed towards a two-position variable-incidence tailplane. The commercial version of this helicopter now being offered to operators has a cruising speed of 85 m.p.h. and a vertical rate of climb of 1,300ft/min at a gross weight of 1,900 lb (I.S.A. +15 deg C).

Folland Gnat (XK 724). The first M.o.S. Gnat, camouflaged, carrying two Aden guns and powered by an Orpheus giving greater thrust than that installed in a Gnat last year, is being flown by Teddy Tennant and Dick Whittington. Observation of a turn-round by the Folland ground crew shows that everything is done without trestles or ladders. All fuelling is through nozzles exposed by the removal of sections of the dorsal spine. Each tank has a long dipstick for visual assessment of contents. Noticeable in this aircraft is the fact that the only apparent aerial is inside the plastic tip of the fin. A hefty lug under each wing is ready to take a pylon. The dorsal spine terminates aft of the rudder in a drag-chute housing.

On the Folland stand in the exhibition marquee is a full-scale mock-up of the new two-seat Gnat Trainer. Each pilot has the benefit of a full-size blind-flying instrument panel in place of the shallow horizontally disposed "scatter" in Gnat XK 724. The nose has been somewhat lengthened to accommodate two pilots in tandem (each with a Folland-Saab lightweight, automatic ejector seat) under a one-piece frameless canopy. Prominent in the front cockpit is an I.L.S. meter. No guns are fitted. A small model carries two 60-gal underwing tanks, six 3in air-to-ground rockets in two tiers of three on one side and a streamlined bomb on the other side.

A picture depicts the Naval Gnat, with a hook extended well aft under the tail. Also exhibited is a cross-section of a six-per-cent-thick wing for a Gnat development. It has a torsion box of two built-up sheet spars joined by a thick skin supported by three intermediate formed sheet spars interspersed between four extruded U-section stringers spaced vertically by plain bars. Leading- and trailing-edges are built up around this torsion box.

Gloster Javelin FAW.4 (XA 764). Exhibited only in the static park, this will shortly be the predominant type of Javelin in service. In common with all versions subsequent to the Mk 1, it has the all-flying horizontal tail, pen-nib fairing above the jet nozzles, and Sapphires of 8,000 to 8,500 lb thrust. Inner wing sweep angle at quarter chord is 39.5 deg and outer panel sweep 33.8 deg.

Features seen for the first time are aileron trailing-edges about two inches thick which give greater control surface effectiveness. Four Aden guns are mounted in the wings and there are attachments for two pylons under each wing. The ventral tanks can be defuelled *in situ*.

Gloster Javelin FAW.7 (XA 778). To supplement and succeed the FAW.4, the higher-powered FAW.7 is now in production. In all major details it is identical with the Mk. 4, but both intakes and effluxes are noticeably larger. The aircraft shown has a metal nose cone of standard Javelin contour which is probably a temporary fitting. That it is to be primarily a missile carrier is indicated by the fact that the gun ports are covered, though not deleted, and the two standard attachments under the wings are surrounded by a line of open rivet holes indicating the fairly generous proportions of streamlined pylons. The inner pylon is mounted between the two gun stations close to the leading edge. New fittings seen on all the Javelins at Farnborough are two pitot heads mounted well aft on top of the fuselage, which are thought to serve duplicated "feel" simulator devices for the tail controls.

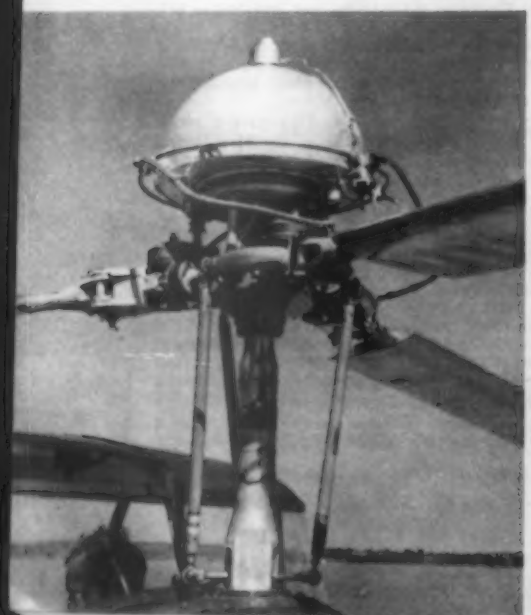
Gloster Javelin T.3 (WT 841). Specially modified by Air Service Training, Ltd., from an early-mark airframe, the T.3 has a completely re-arranged crew compartment and nose section, and also all FAW.4 refinements. Both canopies are considerably higher and the Mk 3 ejector seat for the instructor (rear) pilot is raised several inches above that of the pupil. Furthermore, the rear seat is farther forward than that of the radar observer in fighter Javelins, and the whole nose has therefore been lengthened. While the standard radar nose contours are preserved, the radome is much shorter and contains only a radar-ranging unit. The hood itself is in two large sliding sections meeting, in the closed position, over and under a massive, semi-circular bridge. Rearranged panels low along the side of the forward fuselage cover such items as g-suit units, I.L.S. receivers, and emergency batteries.

Most interesting addition to the T.3 is a periscope installation for the instructor, with sighting lenses mounted in the leading edge of streamlined projections attached some way below the cockpit coaming, level with the instrument panel.

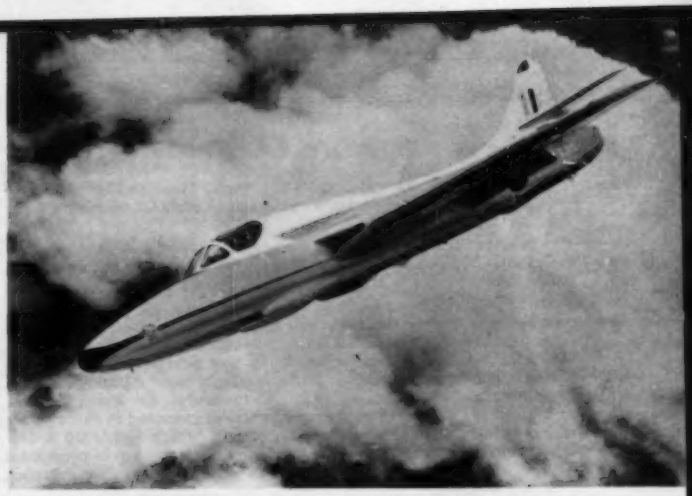
H.D.M. 106. A model of this enterprising Anglo-French freighter project, which combines the Miles company's traditional ingenuity of airframe design with the remarkable Hurel-Dubois high-aspect-ratio wing formula, is to be seen on the Miles stand. An "assessment" prototype of the H.D.M. 106, the 105, is now being built at Shoreham, for flight-testing before the turn of the year; this aircraft will in fact be a standard Miles Aerovan, its wing replaced by the slender-chorded, 75ft 4in-span Hurel-Dubois unit. Once this machine has been evaluated, its wing (complete with the two Lycoming GO-480 engines) will be fitted to a box-shaped fuselage (with rear-loading doors and 563 cu ft in volume) and tail, both of new design. Carrying capacity of the 106 will be one-and-a-half tons or 15 passengers.

Handley Page Laminar-Flow Airliner. On the Handley Page stand new details are given of the potentialities of boundary-layer control in the improvement of big jet airliner efficiency. Reductions of 30 per cent in structure weight and 20 per cent in operating cost—promising a radical change in the commercial abilities of pure-jet airliners—are claimed.

Handley Page Victor B.1 (XA 917). Appearance of this aircraft at Farnborough was confined to a fly-past and demonstration from the first production machine on two days of the S.B.A.C. Show, the aircraft being based on the manufacturer's airfield. This was the first public appearance of a production Victor. A



One of the revelations at Farnborough is the Napier-rocket-boosted Skeeter, the peroxide tank of which is pictured on the left. Below, the third Scottish Aviation Twin Pioneer.



The crimson-and-cream Hunter T.7 looks like a futuristic executive machine; actually it can fulfil multiple military rôles.

touch-and-go landing along the runway enabled the air brakes in the extreme tail and the dangling eight-wheel bogies on the main undercarriage legs to be seen.

Since the appearance of the prototype at the 1953 S.B.A.C. Show the fuselage has been lengthened and the design of the vertical tail cleaned-up, apart from numerous other small changes. Large dielectric areas are situated beneath the cockpit floor and in the rear fuselage. The aircraft is painted in the standard bomber finish of dull silver.

Handley Page Herald (G-AODF). The second prototype Herald, which first flew a month ago, is this year's representative of Handley Page's four-engined, 36/44-passenger branch-liner. It wears a company colour-scheme of silver, blue and white, and bears upon its prominent fin the badge of its recently acquired C. of A. (No. A5027). The cabin, which gives a real and immediate impression of spaciousness and light, is trimmed in greys and reds, and is fitted with 36 seats. The figure for maximum weight stencilled beneath the tail of this prototype—33,500 lb—is not representative of the production aeroplane, the corresponding figure for which is 37,500 lb. A compelling illustration of the aircraft's commercial abilities is to be noted on the Handley Page stand indoors, where a pictorial route-study of the Herald on a notoriously difficult sector out of Bogota, Colombia (8,000ft above sea level), is shown. First deliveries of Heralds will take place during the first half of 1958.

Hawker Hunter F.6. Three of these aircraft figure in the show, two of them, XG 128 and XG 129, being standard F.6s fitted with a variety of underwing stores. XG 128 carries two 100-gal asbestos phenolic tanks and 24 3in rockets while XG 129 has four 100-gal tanks. The inner pylon is raked forward and the outer is straight. Principal innovation in the F.6 is a Rolls-Royce Avon of greatly increased thrust, as shown by a larger jet pipe. Ailerons and elevators are fully powered but the tailplane does not work in conjunction with the elevator. Extra whip aerials now appearing above the outer wings seem to be connected with some directionally-sensitive radio equipment. A destructor is housed behind a quick-opening panel on the port side forward of the cockpit. The absence of a filler cap in the under-wing tanks suggests that the single pressure-refuelling connection in the port wheel bay serves the external tanks also. It is probable that contents gauges, visible from the cockpit in flight, will be fitted in these external tanks. In the Hunter F.6 Plessey propyl nitrate liquid starters replace the cartridge starters of earlier marks.

An entirely new Hunter variant, numbered XG 131, is mounted on jacks in the static park and classified on the accompanying notice as an intercepter and ground-attack development aircraft for the M.o.S. This machine is fitted with 85-gallon partly underslung metal tiptanks permanently attached by a finely faired sleeve over the standard wing tip. Navigation lights and pitot head are mounted in their noses. The c.g. of the tanks would be close to the 70 per cent chord point at the wing root. In other respects this machine is a normal F.6, but disposed around it are 100 gallon drop tanks, small practice bombs, 60-lb rockets, standard 500-lb bombs, American Tiny Tim 5in air-to-ground rockets, long, streamlined, 1,000-lb bombs, less-streamlined 1,000-lb bombs with flip-out fins and the complete gun pack.

A Hawker Hunter cockpit simulator of the fixed-base type, for teaching engine starting and all normal and emergency system procedures, is a prominent feature of the Hawker Siddeley Group's stand. It gives the first view of the Hunter cockpit—though gunsight and fuel quantities are deleted for security purposes. A panel attached outside the cockpit allows an instructor to simulate all types of emergency. The cockpit layout appears excellent, with all controls commonly used in flight positioned to the left. Those dealing with undercarriage, flap, trim indication and control-system hydraulics are grouped to the left of the centrally mounted blind-flying panel. Between the pilot's legs, ahead of the pistol-grip stick, are isolator switches which can all be switched on together by raising a hinged bar. The starter button is also down here. The power lever, with "press-to-transmit" switch, airbrake switch and twist grip for manual gunsight control is on the left. For powered control, aileron spring centering is adjustable through a small wheel mounted on the side of the control column. Hydraulic failure causes two dolls' eyes on the left to turn white, whereupon the controls go into "manual." A single control on the left console can then be manipulated to adjust aerodynamic tabs on rudder and ailerons. In case of tailplane-trim runaway, a red-and-yellow striped cover can be raised on the left console, cutting out the normal trim motor, and a switch beneath it controls a second trim motor. The air-conditioning selector ("auto., cooler, hotter") is well aft on the left console, while D.M.E. panel, fuel gauges and fuel booster-pump switches are on the right console. Though a large striped handle on the left is for jettisoning the hood, Hunters now coming into service have a combined hood-jettisoning and seat-ejection sequencing device initiated by the pulling of the ejector-seat blind.

Hunter (with Fireflash). (XF 310). Basically an F.4 airframe, the Fireflash Hunter is painted blue underneath and carries no national markings despite its British serial number. The two luridly painted Fireflashes are suspended from the standard inner pylon stations. Each missile is suspended on a spigot in front and a ball and socket bearer well aft under the wing, picking up the tail of the Fireflash. In this rear mounting are incorporated the missiles' electrical connections. To accommodate the larger beam-laying radar, the nose is lengthened and the black radome somewhat enlarged. What appears to be a standard gyro gunsight is fitted in the cockpit. Normal Hunter pitot heads are mounted at both wing tips. The four Aden guns are retained. The camera port just aft of the radome is deeper and longer to accommodate either a larger camera or a standard battle camera mounted farther back.

Hunter T.7. (XJ 615). Resplendent in a British-Railways-type red and white colour scheme, the first prototype of the side-by-side two-seat Hunter features a greatly enlarged dorsal fairing aft of the hood. The hood itself still conforms to the old smaller fairing line and in the slight waist effect thus remaining a thick collar of vapour forms at high speed. The bulge on top of the jet nozzle houses a drag chute under a large rectangular panel, well clear of the jet pipe's heat. Two Martin-Baker Mk 4 light-weight seats are installed and two Aden guns are housed within bulges beneath the cockpit.

Hunting Percival Jet Provost T.2 (G-23-1). With the shortened undercarriage and dorsal fin already seen, this machine is the first to have the re-arranged cockpit and single-piece, clear-vision windscreen. The last-named is supported by a single glass-plastic arch. With 1,750 lb thrust, the Armstrong Siddeley Viper ASV.8 allows a maximum level speed of 287 kt and an operational altitude of 35,000ft. The cockpit has been largely rearranged and has a single, central blind-flying panel with engine and fuel dials on the left. Brakes are toe-pedal operated and no ejector seats are fitted. The aircraft demonstrated in flight by Mr. R. G. Wheldon is XD 694, one of the earlier versions with built-up windscreen structure.

Hunting Percival President (G-AOJG). Known until recently as the Prince 5, civil variant of the Pembroke, the Alvis-powered President (as its aptly chosen name suggests) is aimed at the executive market, where its compact roominess and high-wing view are likely to find considerable favour. The cream-and-maroon aircraft at the display, G-AOJG—the first President off the Luton assembly line—is furnished for eight people, with two pairs of seats facing over tables, and it includes a baggage hold of useful dimensions. An unusual feature of this particular aircraft, in which it differs from the Prince and Pembroke, is the installation of Rotol airscrews. A Pembroke C.1 for the R.A.F., XK 884 (45th

Like a giant ray leaping over the deep is Avro's gleaming Vulcan about to squelch on to its reflection on the wet runway.

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off the line), is shown in the static park, furnished in blue with eight rearward-facing seats to a degree of comfort uncommon for a military transport.

Napier Eland Airliner. Although Napier's Eland-engined Convair 340 is not shown at the display, important news of airline interest in the Eland-powered Convair was, as the display opened, expected.

Napier Scorpion-Canberra (WK 163). Converted by the Napier Flight Development Establishment at Luton from a Canberra B.2, this test-bed carries the Napier Scorpion liquid-propellant rocket motor at the rear of the bomb-bay. Although official information on this point is not forthcoming, the flying demonstration makes it evident that the Scorpion mounted in this aircraft has twin combustion chambers, one of which lights up a few seconds after the other. At full thrust the two barrels produce a very substantial push which becomes of predominant importance at top altitude.

The aircraft first flew with the Scorpion on May 20, and has since carried out a fair proportion of its development trials. It arrived at Farnborough on the previous Saturday, but was parked away from public view, both to prevent details of the installation from becoming evident and to obviate the necessity of draining the rocket-fuel tanks. In action, the rocket gave evidence of H.T.P. and hydrocarbon fuel, from the quality and colour of the flame and steam trail. It also showed itself to be aerobatically cleared. Napier emphasize that the Scorpion is designed for sustained firing, long life and reliable control, and also state that it is exceptionally simple and trouble-free.

Rolls-Royce RA.29-Canberra (WD 930). This ageing aircraft, which was once used to begin the flight-development of the RA.14, now has a couple of the latest 200-series Avons with a combined thrust substantially in excess of 20,000 lb. Whereas the Comet 2E will be used for RA.29 route proving, this Canberra is employed on general development and altitude testing of this very efficient civil turbojet. An RA.29 is mounted in the port nacelle, balanced by a corresponding "advanced type of Avon" to starboard.

Rolls-Royce Reverse-thrust Hunter (XF 833). Originally the prototype for the Hunter 6—with a "five-figure thrust" Avon—this aircraft is carrying out flight development of the Rolls-Royce thrust reverser under contract to the Ministry of Supply. As a photograph shows, an orifice is provided on each side of the jet-pipe, in which is mounted a pair of hemispherical eyelid shutters. When the latter are closed, all the efflux from the Avon is forced outwards through the lateral exits, in each of which multiple-cascade vanes are positioned to deflect the jet outwards and forwards. XF 833 is being flown by the company chief test pilot, A. J. Heyworth, who is demonstrating thrust reversal with the aid of a smoke generator. Principal applications are, of course, connected with the Conway for long-range airliners.

Rolls-Royce Tyne-Lincoln (G-37-1). This conventional test-bed is the first to take the superb Tyne turboprop into the air, the experimental installation being in the nose. Some 50 hours' flying have now been logged on two Tynes, and flight development has so far been exemplary in all respects. As was expected, the Lincoln is being flown past at Farnborough with all four Merlins feathered.

Saunders-Roe Skeeter. One of the few surprises at this year's S.B.A.C. show is the demonstration of G-ANMI, a Skeeter 5 fitted with rocket boost in the form of Napier tip-thrust units. The fuel, which is high-test peroxide, is carried in a tank mounted above the rotor hub, and is pumped through the blades to the rocket units by centrifugal action. On entering the tip unit the liquid H.T.P. is decomposed into superheated steam and oxygen by means of a catalyst. The generated gases then pass to a nozzle at the tip of each rotor blade, through which the H.T.P. steam is ejected at high velocity to provide the thrust reaction. Over 100 test runs have been made in some ten hours' flying during the last few weeks. Weight of the total installation is less than 30 lb (plus 90 lb of H.T.P., giving a duration of about 2½ min), while the thrust from each unit is 22 lb. The vertical rate of climb of the Skeeter 6, it is claimed, is increased from 230ft/min to 1,400ft/min by the tip units, and the sea-level rate of climb from 1,020ft/min to 1,800ft/min (I.C.A.N. conditions, identical payloads and piston-engine fuel weights). Also demonstrated at Farnborough is XK 479, the first production Mk 10 Skeeter; while on the Saunders-Roe stand is the major portion of the second production Skeeter 6, and a bonded-metal rotor blade.

Scottish Aviation Prestwick Pioneer (XL 664). No S.B.A.C. Show would be complete without a demonstration, provided again this year, of the Scottish Aviation Pioneer's quick dismissal of the Farnborough runway. The machine displayed is the 29th for the Royal Air Force, XL 664. This agile four-seater has, for good measure, a full civil Certificate of Airworthiness.

Scottish Aviation Twin Pioneers (G-AOEN and G-AOEO). Two Twin Pioneers each bore a pleasant surprise to the show this year. One, G-AOEN (the second machine built), appears in the blue, white and red colours of de Kroonduif, the Dutch New Guinea associate of K.L.M.; the other, Twin Pioneer number three, G-AOEO (static park), wears the highly prized markings of Swissair—the first fruit, no doubt, of the same aircraft's recent demonstrations in Switzerland, West Germany and Austria. Scottish Aviation, while not confirming that there are definite orders from either airline, leave visitors to the display "to draw their own conclusions." G-AOEN demonstrates the take-off and landing characteristics of the Pioneer breed, which go of course with a commercial load of 16 passengers. The forward portion of the three-abreast cabin is reproduced on the company's stand indoors by an actual Twin Pioneer nose section, cut at frame 9: the lightweight seats are particularly worthy of appraisal. A small detail not before noted on the aircraft are the airscrew blade root-cuffs, designed to sustain engine-cooling airflow at low speeds. Soon—probably by the time these words are read—the Twin Pioneer will have its C. of A.

Short Gyron-Sperrin (VX 158). Entered by the de Havilland Engine Company, this bulky bomber is carrying out a most responsible task as the first test-bed for the powerful Gyron turbojet. The first flight-cleared Gyron was installed (in the lower port engine-position) over a year ago, the conversion being done by the aircraft-manufacturer, Short and Harland, at Aldergrove. The aircraft first flew with a Gyron installed on July 7 last year. The following month Chris Beaumont brought it to Hatfield, where it has since been based.

This year VX 158 was returned to Aldergrove where a second Gyron was installed in the lower starboard position. The first ground run took place on June 4 and the first flight on June 26, the pilot being "Jock" Eassie. On August 29 R. Plenderleith brought the Sperrin back to Hatfield and twin-Gyron trials are now well in hand.

Short Seamew (XE 174). The Seamew appearing in the static park at Farnborough in Naval colours is deduced from its serial number XE 174 to be the sixth production aircraft. Powered by an Armstrong Siddeley Mamba, this light anti-submarine aircraft is able to carry an impressive quantity of bomb-cell stores amounting to a total load of over 1,800 lb in its 14ft bay. Displayed around the machine on view are alternative loads of two depth charges and five sonobuoys, ten sonobuoys, four depth charges or 12 small sonobuoys and under each wing four small sonobuoys are hung on external racks and three rocket projectiles are mounted outboard of the undercarriage legs.

Vickers-Armstrongs Supermarine N.113 (WT 859). One of the two prototypes of this Fleet Air Arm strike fighter was demonstrated but, at least early in the week, did not land. It was painted in the new Fleet Air Arm colour scheme. The type underwent carrier trials in April and production aircraft should appear in the near future.

Vickers-Armstrongs Supermarine Swift F.R.5 (WK 296). Identical with those now in service with Nos. 2 and 79 Squadrons

The nose of the D.H.110 (left) illustrates the latest Fleet Air Arm colour scheme of two shades of grey. On the right is the beautifully profiled fixed tank on the wing tip of a Hawker Hunter F.6; around the aircraft is disposed a considerable assortment of stores.

in 2nd T.A.F., this machine has covered ports for three F.95 cameras in the nose, two Aden guns, a "saw-tooth" wing, a gun-camera mounted in the nosewheel door, a V.I. tailplane and an afterburning Rolls-Royce Avon. Performance at low level and rate of climb are outstanding. The standard 225-gallon ventral tank is fitted. Two of the many flush intakes over the engine bay have aerofoil section flaps over them, possibly intended to vary the intake area. Mounting points for four rocket rails appear under each outer wing, together with fuel-tank access panels.

Vickers-Armstrongs Supermarine Swift Mk 7 (XF 113). Built under M.o.S. contract, this is one of the machines destined for the Service trials of the Fairey Fireflash. Though it can carry four of these missiles, only two are in place at Farnborough. The third and fourth pylons attach inboard, ahead of the undercarriage leg stowage. Unlike the Hunter installation, the Swift has a long fore-and-aft pylon structure to carry the Fireflash by its two suspension fittings. The missiles are also set to allow for a high angle of attack for the wing. Gun armament has been totally removed and replaced by fuel tanks. The whole nose forward of the canopy is redesigned and lengthened, the windscreen featuring a modified curved section with parallel struts.

At least for the time being, no radome is fitted in the nose, but a fairly large suppressed aerial is mounted high in the leading edge of the fin. The nosewheel door is rectangular and carries no camera. About 18in has been added to each wing, the extra section being fitted round the end of the aileron, which previously formed part of the wing-tip. There is an extra pitot head on the port wing. The gunsight appears to have been replaced by a small dial gauge.

Vickers-Armstrongs Valiant (WB 215). Fitted with de Havilland Super Sprite liquid-fuel rockets in jettisonable containers the second prototype Valiant demonstrates the short take-off and steep climb resulting from the extra 8,400 lb thrust available. The rocket containers, which are slung between each pair of engines, are normally jettisoned when the propellant tanks are exhausted (after some 40 sec) and are fitted with inclined fins and automatically operated parachutes.

This assisted take-off technique has been developed to enable R.A.F. Valiants to operate at full weight from short or high-altitude runways when the air temperature is high. As demonstrated at Farnborough the Super Sprite's kerosine burns in the H.T.P. with a bright orange flame. A television camera is installed in a fairing on the port fuselage side to enable the rocket firing and jettison to be observed from the cockpit. Valiants have been in service with the R.A.F. since the spring of this year, and to date four squadrons are known to have been so equipped.

Vickers-Armstrongs Vanguard. Two models of Vickers' formula for the "ideal" turboprop medium-hauler, the big-capacity Vanguard, appear on the Vickers stand. One of them is displayed as a freighter, with big doors.

Vickers-Armstrongs Viscount (G-AOJA). The show this year includes the first representative of the new family of faster and bigger-capacity Viscounts—the first 802 for B.E.A., G-AOJA *Sir Samuel White Baker*. This particular aircraft has now completed 36 hr of its flight trials, most of which have been devoted to a performance comparison with the standard Viscount 700. The next phase of the test-programme will be concerned with certification, and delivery will be made to enable introduction of the first B.E.A. 802 service (London-Paris initially) in December. All 24 of the Corporation's new fleet will be in service by next summer. The full 800-series capacity of up to 70 passengers is not being utilized as yet by B.E.A.: G-AOJA, as shown at the display, seats 53, leaving generous room forward for the galley (port side) and freight to starboard. Seats (short-built) are trimmed in a new and attractive material of corded pink with red arm-rests, and—as in B.E.A.'s 701s—half the seats (those at the front) are rearward facing. Powerplant is the Dart 510, driving square-tipped wide-bladed Rotol airscrews—now the standard installation on all new Viscounts; the bulged form of the outboard engine nacelles (introduced to improve cooling) is particularly noticeable.

Developed entirely by Rolls-Royce is this neat installation which reverses the five-figure thrust of a Hunter 6's Avon. The aircraft was actually the first Hunter to have such an engine.

Westland Widgeons (G-ALIK and G-AKTW). The twin Widgeons appearing this year are the well-known G-ALIK, the prototype; and G-AKTW, which was the first S-51 built by Westlands. Of the two at Farnborough, the blue-and-white G-ALIK is fitted for the ambulance rôle—and is demonstrated with two stretcher cases and a nurse aboard; while the red-and-white executive transport version G-AKTW carries in its comfortable red seats four "typical executives" complete with (according to the commentator) bowler hats and briefcases.

Westland Whirlwind H.A.R.5 (XJ 396). The prototype of the Alvis Leonides Major Whirlwind has now logged 100 hours' running time, about 30 of which have been in the air, and (as seen at Farnborough) now incorporates the drooped-tailcone modification applicable to all Whirlwinds. Ground-running of the type-test Leonides Major in a second Whirlwind is about to begin at Yeovil.

GUIDED MISSILES

IT is particularly in the field of guided weapons that this year's S.B.A.C. show can be stated to excel. More than ever before, tangible evidence of real progress is on display in the form of models, films, photographs and actual hardware.

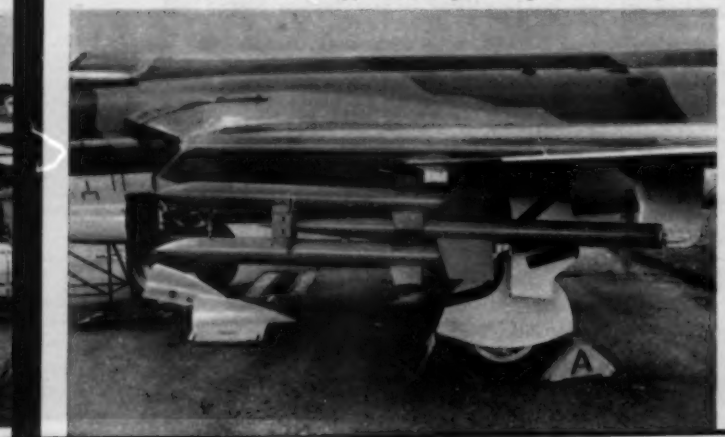
Pride of place must surely be given to the Fairey Fireflash air-to-air weapon, which has been described as the first British guided missile to have destroyed a target aircraft (in April 1954) and is also the first such weapon to have been delivered in quantity to the Royal Air Force. No details of the production of the weapon may be published, but service-test quantities are at present being built by the Fairey Weapon Division at Heston.

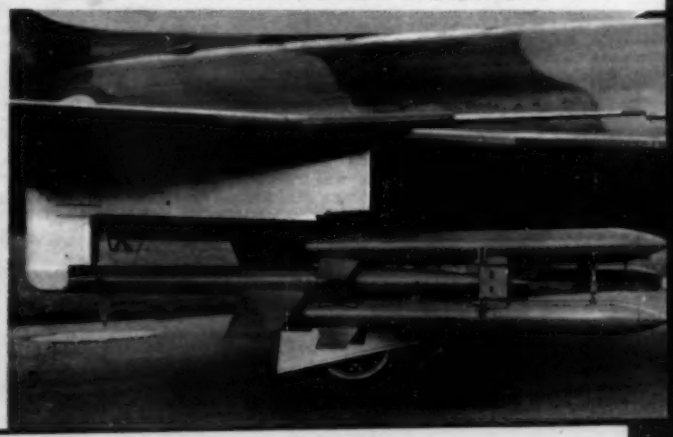
The two photographs below show the characteristics of this unusual weapon to advantage. The missile itself has no motor but is accelerated to supersonic speed by upper and lower booster motors. These are jettisoned at the burn-out point, after which the round itself coasts ballistically along a guiding radar beam emanating from the launching aircraft. The nozzles of the twin motors are canted outwards but induce no spin, the complete missile being roll-velocity-stabilized but not position-stabilized.

The solid machined wings, of 2ft 4in span, are of parallel double-wedge section at the tips, changing to bi-convex section at the bolted roots. The control surfaces are set at 45 deg with respect to the wings. Overall length is given as 9ft 4in (7ft 6in without boosters) and the seamless body, which has a pointed ogive nose, has a diameter of roughly 6in. The boosters are clearly built-up structures of wrapped and riveted sheet, with the actual rockets themselves separated from the skin. They are latched together by an explosive bolt at the front and by a cast U-shaped support secured by pinned lugs.

Altogether, nearly a dozen Fireflashes can be seen, in the static park, on the Fairey company's stand, and on several aircraft. All are painted bright fluorescent red and none is equipped with complete electronics and aerial systems. On the Fairey stand there is also to be seen an "operational airfield test set," on which the Fireflash airframe (less boosters) is mounted for pre-flight check-

Two instructive comparative views of the Fairey Fireflash installations on the Hunter (left) and Swift (right). In the latter case the Fireflash is mounted with an appreciable negative angle of incidence; the two machines also differ in their respective sighting and ranging equipment.





THE SEVENTEENTH S.B.A.C. DISPLAY . . .

ing. With the aid of this equipment each round has its servos, fuse-functioning and beam-riding head checked before firing.

Other highlights of the missile exhibits include: examples of large missile rocket motors and several aspects of ramjet development by Bristol Aircraft, Ltd.; a combined display by Bristol Aircraft, Bristol Aero-Engines and Ferranti; two models of English Electric missiles with tandem and wrap-round booster motors respectively; a huge array of missile accessories and test equipment; and exhibits by the Ministry of Supply which include several items referring to upper-atmosphere research vehicles and a liquid-propellant chamber rated at no less than 50,000 lb thrust.

MONDAY'S FLYING

TO Act I (or Group A, to observe the punctilio of the official brief) had been assigned a strangely assorted company of flying test-beds and a single flying barrack block—for such this year is the Blackburn Beverley.

With the Beverley standing at the ready a hundred soldiers approached in three green trucks. There followed a smart job of parking and the men debouched, each handing his rifle to a sergeant as he emplaned. In under two minutes all were aboard. A pause of a few moments while Tim Wood waited tower clearance and the barracks set off up the runway. After, perhaps, 600 yards the wheels were off and the Beverley came hauling round for an immediate landing approach. The bogies touched; then full brake and full reverse pitch, and the giant was still. In a minute and a quarter a hundred pairs of boots had pounded the runway again.

Looking like a bruiser with two gumboils, and bellowing like the same, the Gyron-Sperrin lunged into the air, followed by the Scorpion-Canberra, with tongues of venomous-looking flame spitting from the rocket barrels, the lighting whereof was marked by a dirty smoke puff. A brisk upward roll was a reminder that the Scorpion is intended for fighter application. Following up, like the old trouper she is (though having one of the world's most modern turboprops out-front) came the Rolls-Royce Tyne-Lincoln, bereft of Service markings. The old-timer soared up like a lark and did her stuff very low (and oh so quietly) with the Tyne as her sole means of support.

Hucknall's second performer, the Avon RA.29-Canberra, epitomized the mighty, though frugal, power source now being developed for the new Comets; but even more significant, in a military as well as a civil sense, was the Reverse-Thrust Hunter, Jim Heyworth up. The Rolls-Royce boffins had conceived the typically bright notion of fitting a smoke bottle to discharge into the jet-pipe, thus rendering the action of the reversal clearly visible. The run after touchdown was, perhaps, 500 yards, and the whole performance was one of those strictly-to-the-point, wholly convincing, affairs that one has come to associate with the names Rolls-Royce, Hucknall and Heyworth.

Standard Hunters—F.4s—were those of No. 43 Squadron, Royal Air Force, which now nosed down over Laffan's Plain, with F/L. Peter Bairsto in the lead, and F/O.s Ronald Smith, A. M. Stabler and M. S. Wild making up the box. These prize aerobatic birds of the "Fighting Cocks" Squadron appeared to see red where everyone else saw grey, and they flew at the cloud-mass with only meagre and grudging help from one or two gaping blue-patches.

To F/L. Bairsto, for his dashing exposition of fighter leadership, a bouquet from the editorial caravan (well watered by this time).

Bristol opened the helicopter frolics with the Sycamore and 173, the latter looking even more impressively airlinerish with its new twin-finned horizontal tail. Saunders-Roe were doubling up, too, having the Skeeter 5 as well as the Mk 6 as advertised. The "5," in fact, was something of a dark horse, having been given a highly efficacious shot-in-the-rotor by Napier, as described on page 436. With its tiny tip-jets hissing, the little prototype whisked up like a skyscraper lift to a thousand feet.

The Westland act was surely the best and brightest of its kind ever, with Roy Bradley performing prodigious feats, mostly over the vertical, in a Service Whirlwind. His stooges (if a pair of uncommonly well turned out Widgeons may be so described) backed him up in a manner bespeaking unflinching trust in the leading man and in one another. These Westland Brothers achieved stardom there and then.

That Fairey's Ultra-Light helicopter has not exactly laid down and died since it was orphaned by withdrawal of State support was evident when it clambered up from a lorry at the decidedly healthy rate of 1,300 ft/min and plummeted down again like a little bomb to within a few feet of the grass—there to be seated with Fauntleroy decorum. Then it got up and hitched another ride on the lorry.

That the Air Ministry is alive to the value of showmanship in terms of salesmanship was evident from their claim that the demonstration by the four Canberra T.4s of No. 231 O.C.U., Bomber Command, is "the most intricate Canberra demonstration ever performed in public." (Note to Whitehall: This is a slight understatement. And did your Security Chiefs go clean through the top storey on hearing that Oliver Stewart had declared a weight of "over 21 tons" for the Canberra?)

Of this particular weather-stricken performance we need only add that, collectively and individually, flat out or on the stall, these Canberras impress their flying—as they do the public—with the stamp of 231 O.C.U. Their bomb burst is a real block-buster—as bewildering in execution as is Ranald Porteous's Aiglet Trainer "avalanche," which he now proceeded to set in motion from a low level. (We are confidently assured that this is merely a flick roll over the top of a loop.)

Dick Wheldon's fast rolls in the Hunting Percival Jet Provost were as clean cut as, we may be sure, are the young men who are now flying these trainers as daily routine. Who could say more? Ted Tennant, in the Folland "Ministry Gnat," was another exponent of the "deadbeat" roll. Every flittering, fleeting caper of the Gnat, of course, has an appeal all its own; but that appeal is not the sole prerogative of the tiny tots, and that it can be exerted by the most puissant twin-jet all-weather destroyers was thereupon proved by Peter Varley and Geoff Worrall respectively in the Gloster Javelin FAW.7 and T.3. The FAW.7, with its as yet uncommonly high-rated Sapphires, managed to get in a run which looked exceedingly fast, even when one remembered that a Javelin is big enough to swallow several Gnats. The T.3 trainer appears to be suffering no inhibitions notwithstanding the prototype status of its cockpit canopies.

Just as the Javelin 7 made telling use of its greater thrust, so did the newest examples among the four Hunters which Hawker now presented. Their perfectly co-ordinated and zestful performance opened with Bill Bedford taking off in the gaudy, though masculine-shouldered, Hunter T.7 from the "wrong" (Laffan's Plain) end of the runway. Forthwith his three confederates, manning the Fireflash-Hunter 4 and two Hunter 6s (one with four tanks, the second with R.P.s and tanks), got going in the opposite sense. What with the sheets of rain, flashes of vapour-shimmy, and tremendous fulminations of high-thrust Avons in the Mk 6 machines, as they lanced towards the clouds at an astounding angle and rate of climb, this "ballet" (as we termed it earlier) is perhaps better likened to Wagnerian opera.

Confident of its all-weather capability, the D.H.110 lunged off into the grey to return in a peal of its own thunder, with vapour-flashes enhancing the Valkyrie scene. (Is it too banal to report that a wheel-door was observed open during one low—and vastly impressive—roll?)

Using reheat from the start of its run, the Swift Mk 7 got its two Fireflash missiles airborne in short order, and was thereafter hurled around and about looking, with its fusiform fuselage, much like a missile itself.

Peter Twiss now made his number in the Fairey F.D.2 record machine, which blasted off the spray-clouded runway into a murkiness which Twiss proceeded to illuminate by a colourful R/T. description. And if the Swift looked like a missile, the spiky Fairey delta exhibited all the characteristics of a gimlet as it bored over in a flashing series of rolls. It was said that the reheat—which was, of course, demonstrated—could be kept on only for six or seven seconds without exceeding permissible low-level speed.

Roland Beamont's feelings on the necessary withdrawal of his beloved P.1 can only be imagined; but he consoled himself—and all beholders—with the wide-span, high-thrust Canberra P.R.9. Here once again was the master hand on stick, throttle and tail trimmer; low, tight, immaculate flying of the Beamont kind. There is none finer.

A Roland for a Roland now, with Avro's Falk—no less renowned than "Bea"—pointing the aquiline nose of a production Avro Vulcan steeply cloudward and keeling the great delta over in a steep turn. His declared intent was to display slow-flying qualities; and, of course, he soon had the mighty bomber sitting up and seemingly begging for more at a shade over 100 knots. He popped the brake-chute several feet above the runway and the Vulcan deposited itself with decision.

Spitting orange flames from its underslung Super Sprite A.T.O. packs, a Vickers Valiant (Brian Trubshaw) was sent aloft with a gigantic heave, presenting itself against the low-hanging cloud like some spectral fiery monster.

Handley Page completed the V-bomber picture with a touch-and-go and a low pass by a Victor, its great fuselage glinting livid against the pall of murk. A like background revealed the Viscount 802 to perfection—lustrous, emblazoned, immaculate.

A D.H. Heron, a Hunting Percival Pembroke C.1 and a Scottish Aviation Prestwick Pioneer made their strong and particular claims on the viewers' attention; a Gannet A.S.4 made Fairey-light work of two tons of naval stores; an A.W./Hawker Sea Hawk gave as pretty a show as ever, though itself laden to the gunwales at Admiralty behest; and the Handley Page Herald, Scottish Aviation Twin Pioneer and the new Hunting Percival President showed passengers and viewers alike how British manufacturers have come forward with small and medium airliners which ask little in the way of field space and offer much in return.

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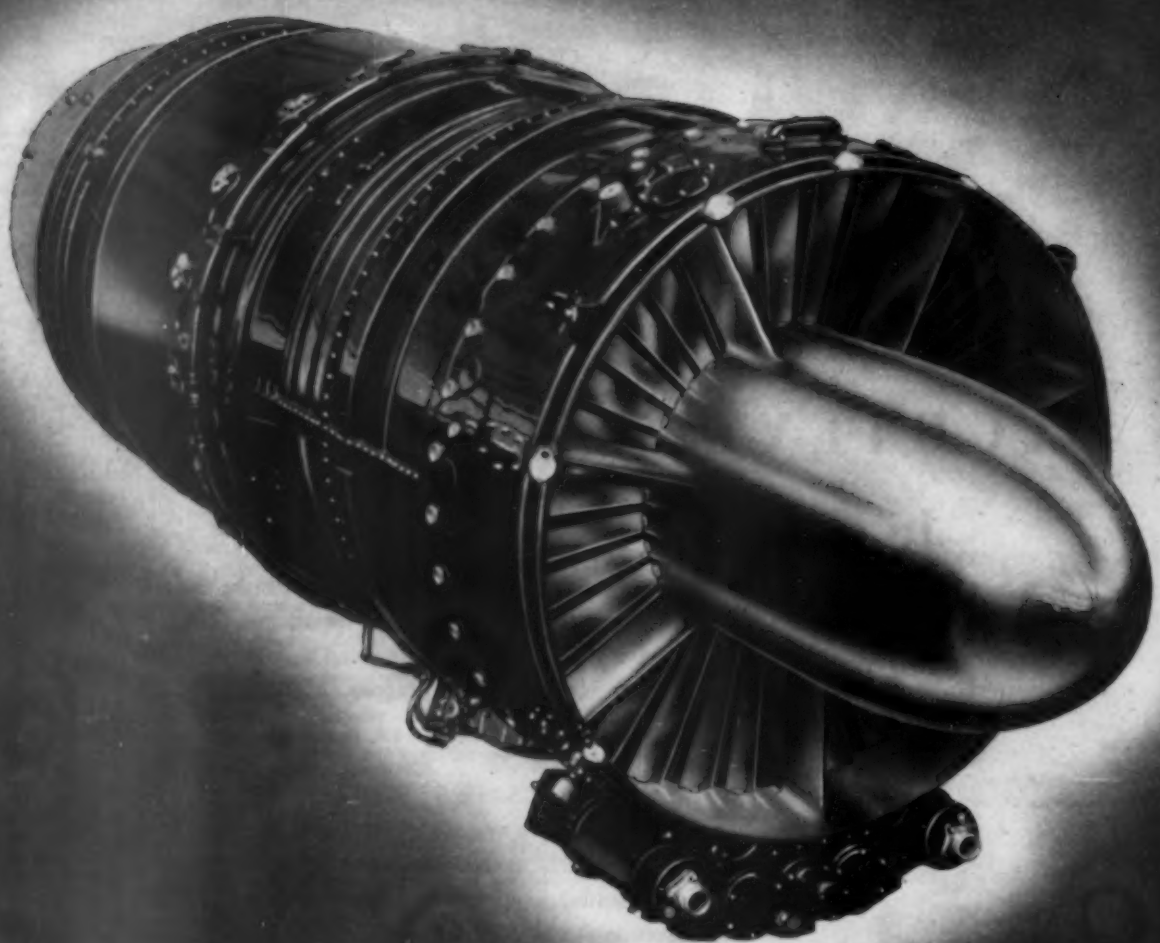

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THE DISPLAY PILOTS

Personalities of the Men who are this week Demonstrating Britain's Aircraft and Engines

TEST flying is arduous and exacting and, contrary to general belief, much of it is anything but glamorous. A prototype may fly for only a few hours during the first months after its completion, but the test pilot is concerned all the time in watching over his charge and preparing for the vital tests in the air. His is the task of assessing the results of the designers' and engineers' years of work and preparation. He must evaluate the new aircraft thoroughly and searchingly and guide its development so that when it is delivered to the user everything is known about it and its behaviour is as nearly ideal as it is possible to make it. This is a task requiring experience, knowledge and judgment in addition to perseverance, presence of mind and courage.

But in terms of hours flown, the testing of new aircraft accounts for but a small proportion of all the test flying which is carried out from day to day over the British Isles. There are new engines, new weapons, modifications and a host of items of equipment, not to mention new procedures and techniques, which all have to receive the same searching attention as a new airframe; and any one of them might be almost as difficult to prove. For this work few names are ever mentioned; the headlines proclaim the mishaps rather than the steady progress.

Though the Farnborough Show is one of the rare occasions when the pilots themselves catch the public eye, it offers them little opportunity for relaxation. The strain is considerable, since much may depend on the proper showing of new products. Few ordinary spectators consider the difficulties of making the best of an aircraft which is yet in its early stages of development; nor are they easily able to appreciate the potential of a new engine or airframe unless it is forcefully demonstrated. Weather and time too often conspire to add their own hindrances to an already difficult task.

This year some 70 test pilots will be flying during the week, not counting the Service pilots who will be providing the R.A.F.'s own part of the show. Many have been at S.B.A.C. shows before, and some are new. Some are already known throughout the country and the world; others have achieved great things during the past twelve months.

Year in, year out, regardless of shows and public appearances, the work goes on. New test pilots are trained by the Empire Test Pilots' School and new airframes, engines and equipment come up for test and evaluation. It is at Farnborough each year that some of the results can be shown to representatives of other countries, and to the British public, as a form of progress report on the year's work.

F/L. J. W. ALLAM (Victor B.1): *Served with R.A.F. for 11 years, Training and Transport Commands. Was personal pilot to Air Marshal R. L. R. Atcherley when latter was C.-in-C., Royal Pakistan Air Force. Attended No. 9 course at E.T.P.S., was attached U.S. Navy before serving at A. and A.E.E. Joined Handley Page as a test pilot in 1954.*

J. D. BAKER (Shackleton M.R.3): *Joined R.A.F. in 1941 and flew Bostons and Mitchells in T.A.F. From 1944-48 tested aircraft at A. and A.E.E. and also flying boats at Felixstowe. Joined Avros in 1948 as Shackleton test pilot. Was pilot during initial flights of first Avro-built Canberra and later did research flying on the 707.*

A. R. BARNARD (Rolls-Royce-engined types): *Joined Rolls-Royce 1952. Served in R.A.F. from 1942 and transferred to F.A.A. in 1944, training on Corsairs. Served in Far East until 1946 and later joined 800 Sqn. on four-year extended commission. Recalled for 18 months during Korea war and qualified then as B.1 instructor, C.F.S.*

W/C. R. P. BEAMONT, O.B.E., D.S.O., D.F.C. (P.1): *English Electric's manager of flight operations and chief test pilot. First flights of Canberra, P.1. Entered R.A.F. in 1938, shot down five enemy aircraft in Battle of Britain and later became C.O. of 609 Sqn. Destroyed 32 flying bombs; was shot down and captured in 1944 but released a few months later. After the war became test pilot with Glosters, joining English Electric in 1947.*

C. D. BEAUMONT (Sperrin): *Has been chief test pilot of de Havilland Engine Company since 1946. Joined R.A.F. in 1934 and transferred to R.A.F.O. in 1938. Was with D.H. School of Flying from 1938-40, and again with R.A.F. from 1940-46.*

A. W. BEDFORD (Hunter T.7): *With R.A.F. for 11 years, serving in Fighter Command in the war, and in peace-time with Training Command and the M.o.S. Ex-instructor of E.T.P.S., and also served as R.A.E. test pilot. Left R.A.F. in 1951 to join Hawkers. Holds seven gliding records, including U.S. absolute altitude, and British distance and goal flight records.*

Lt. Cdr. R. BRADLEY (Whirlwind Mk 5): *Served in Fleet Air Arm from 1941-46, flying with 1833 Sqn., and later as C.O. of Command Flight, Donibristle. Became chief test pilot of Helliwells after the war, and joined Westlands as experimental test pilot in 1950. Has flown over 4,300 hr on 68 types, including 1,200 hr on helicopters. Is now assistant chief test pilot of Westlands.*

G. R. BRYCE (Viscount 802): *Chief test pilot of Vickers-Armstrongs since 1951. First flew in 1939, when he joined R.A.F. During the war served in Fighter, Coastal and Transport Commands. After service as pilot of the King's Flight Vikings he joined Vickers in 1946. Has flown some 45 different types and has more than 6,000 hours.*

F. BULLEN (Hunter F.4 with Fireflash): *Flew Spitfires and Mustangs with R.A.F. Fighter Command during the war. He joined Blackburns in 1946 as a test pilot, and Hawkers three years later. Is now chief production test pilot and has over 4,000 hours' flying.*

W/C. N. J. CAPPER, A.F.C. (Twin Pioneer): *Started flying in the R.A.F. in 1929. Civil pilot with Hillman's Airways and Imperial Airways, 1934-36. Was flying instructor and then C.F.I. with Scottish Aviation until 1939. Served with the R.A.F. from 1939 to 1944. Subsequently rejoined Scottish Aviation in 1945, and has over 7,500 hr, including something over 300 hr on helicopters.*

H. K. CARTWRIGHT (Scorpion-Canberra): *Trained at D.H. Technical School, 1935-38 and was in Kenya with Wilson Airways until 1940, then with 30 Sqn. overseas. Returned to undertake fighter testing in 1944, was attached to Napiers on Sabre development and has remained there. Now has some 3,800 hours in his log.*

R. J. CHANDLER (Beverley): *Joined the R.A.F. in 1941, and did a tour of duty in the Middle East, Italy and North Africa. After demobilisation he joined the North Sea Air Transport Company based at Brough, and in 1950 became a test pilot. Is now production test pilot of Blackburns at Brough.*

THE DISPLAY PILOTS . . .

W/C. D. de VILLIERS, A.F.C. (P.1): *Chief experimental test pilot of English Electric. Flew Beaufighters with 68 Sqn. during the war and was also in Middle East. After work with 282 Sqn. in Britain was seconded to D.H. Left R.A.F. in 1946 and in 1948 was appointed chief test pilot of de Havilland Propellers. Was awarded A.F.C. while with 500 Sqn. R.Aux.A.F. and is now a deputy controller, R.Aux.A.F., at Fighter Command H.Q.*

S/L. N. DUKE (Hunter): *Has been with Hawkers since 1948, and chief test pilot since 1951. Served with R.A.F., and destroyed 18 enemy aircraft during war. Attended E.T.P.S. 1946 and was at A. and A.E.E. 1947-48. Established London - Rome-Karachi and London-Cairo speed records in 1949, and world speed record of 726 m.p.h. in 1953.*

J. ELLIOT (D.H.110): *With R.N. 1941-54. Has been on active service in Korea and attended E.T.P.S. where, in 1948, he won the McKenna Trophy. Was with R.A.E. from 1949 to 1952 and, until joining de Havillands, was posted to the Mediterranean. Has been chief test pilot at the Christchurch factory since 1954.*

R. J. FALK, O.B.E., A.F.C. (Vulcan B.1): *Joined Avros in 1950 and was appointed Superintendent of Flying four years later. Has about 7,000 hr as pilot in charge. Flew in the Abyssinian war and in Spain in 1936. Was an A.R.B. test pilot 1936-39, became chief test pilot at Farnborough in 1943. Has flown 300 different aircraft, including flying boats, jet- and rocket-propelled types, and flew the Vulcan on its maiden flight.*

J. S. FAY (Widgeon): *Test pilot and C.F.I. of Westlands; joined Fleet Air Arm in 1940 and first flew helicopters in 1944. After leaving the Service flew with B.E.A. helicopter unit for five years, joining Westlands in 1952. Has 2,700 hr on helicopters, including 1,000 hr as an instructor.*

E. G. FRANKLIN, D.S.C. (Sea Hawk 6): *Became chief test pilot of Armstrong Whitworth in 1948, having been apprenticed to the company in 1937. Joined R.A.F.V.R. in 1939; did two tours in Bomber Command on Whitleys, Halifaxes and Lancasters. Began test flying at A. and A.E.E. in 1943 and later completed course at E.T.P.S. Rejoined A. and A.E.E. before becoming A.W.A. test pilot in 1945.*

J. R. FRAZER (Widgeon): *Was born in Australia, and joined the R.A.F. in 1941, serving in the south Pacific. Completed the Test Pilots' course with the R.A.A.F. in 1950 and flew at the Woomera rocket range until 1952. He joined Westlands in the following year.*

S/L. W. R. GELLATLY (Ultra-Light Helicopter): *Enlisted in R.N.Z.A.F. 1940. Did operational flying on light bombers and general reconnaissance. Squadron Commander of 293 Sqn., 1944-45. Permanent commission in R.A.F. obtained 1947. Completed E.T.P.S. course, 1950. Attended R.A.F. Staff College course, 1954, and joined Faireys, April 1955. Has flown 51 types, 12 of them rotary-wing aircraft.*

W/C. W. F. GIBB, D.S.O., D.F.C. (Britannia 101 and 301): *Apprenticed to Bristols in 1937. Served in R.A.F. 1940-46 mainly on night fighters. In 1946 rejoined Bristols and was co-pilot of Brabazon on its first flight. Holds world altitude record in Olympus-Canberra, and is now Bristol assistant chief test pilot.*

S/L. J. G. HARRISON (Shackleton M.R.3): *In 1935 joined R.A.F. and was commissioned in 1942. Served with 605 Sqn. and later on 64 Group Northern Reserve Air Staff. At E.T.P.S. course in 1949 was runner-up for the McKenna Trophy. Completed a course at the R.A.F. Staff College in 1952.*

S/L. H. G. HAZELDEN, D.F.C. (Herald): *Was appointed chief test pilot at Handley Page in 1947 and currently responsible for flight test development of Victor and Herald. Served with 44 and 83 Sqns. and as assistant chief instructor at No. 11 O.T.U. Joined No. 1 course at E.T.P.S., 1943, and was posted in 1944 to A. and A.E.E., where he was later appointed O.C. of Civil Aircraft Test Section.*

A. J. HEYWORTH, D.F.C. (Rolls-Royce-engined types): *Having been posted to Rolls-Royce for special duties in 1944, was appointed chief test pilot in 1954. Served with 12 Sqn. Bomber Command during war and completed two tours of operations, gaining bar to D.F.C. and Mention in Despatches.*

P. HILLWOOD, D.F.C. (Canberra P.R.9): *Became experimental test pilot with English Electric in 1949. Began flying with R.A.F. V.R. in 1938 and after serving with Fighter Command went to Canada as instructor. Returned to Fighter Command in 1943 and served in France, Belgium and Holland. Co-pilot of record transatlantic Canberra which won Britannia Trophy. Has flown 50 different types, including P.1.*

C. T. D. HOSEGOOD (Bristol 173 and Sycamore): *Chief helicopter test pilot of Bristol Aircraft. Joined R.N. in 1939 and flew catapult aircraft from armed merchant ships in Battle of Atlantic. Took specialized helicopter flying training course in U.S. in 1944, was appointed naval experimental helicopter pilot, and was loaned to R.A.F. Joined Bristols in 1948.*

J. J. M. JEFFERY (Skeeter): *Joined Fleet Air Arm in 1940 and graduated in first Helicopter Instructors' Course, U.S.A., in 1943. Became naval helicopter test pilot attached to Aerial Torpedo Development Unit and Air/Sea Warfare Development Unit, 1944-46. Joined Saunders-Roe as test pilot in 1951.*

C. A. C. JONAS (Rolls-Royce-engined types): *Was granted permanent commission in R.A.F., having joined Cambridge U.A.S. in 1947. Completed a tour in Transport Command, R.A.F., on Hastings. Completed E.T.P.S. course in 1952 and served with "B" Squadron at A. and A.E.E. Joined Rolls-Royce in 1954.*

Lt.-Cdr. M. J. LITHGOW (N.113): *After joining R.N. in 1938, became test pilot at A. and A.E.E. in 1943. Posted to E.T.P.S. in early 1944. Was naval test pilot, British Air Commission, U.S. Naval Air Test Centre, 1944-45. Joined Vickers Supermarine that year after release from Navy. Set up 100 km closed-circuit speed record in Attacker and in 1953 world speed record in Swift F.4.*

J. G. McCOWAN (Sea Hawk FGA.6): *Joined R.A.F. as boy entrant in 1937. Posted to U.S.A. and Canada as instructor in 1941. Served with 5 and 84 Sqns. in Malaya and Burma, 1944-47. Posted to Day Fighter Conversion Unit and, later, to Armaments Practice School, Acklington. Left R.A.F. in 1951 to join Airwork and later, Armstrong Whitworth aircraft.*

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THE DISPLAY PILOTS . . .

W/C. R. F. MARTIN, D.F.C., A.F.C. (Javelin): *Graduated from Cranwell, 1939, served with 73 Sqn. in France, also with M.E.A.F. and Transport Command. Went to E.T.P.S. after war and later was flight commander at R.A.E. Subsequently returned to E.T.P.S. as instructor. Has over 3,600 hr on 150 types and is now Gloster Aircraft Company's chief test pilot.*

D. MASTERS (Gannet A.S.4): *Now senior test pilot, Fairey Aviation Company, Ringway. Served in R.A.F.V.R. from 1938-46. Became instructor with Rhodesian Air Training Group 1940-43. Served with Bomber Command 1944-46, in which year he took course at E.T.P.S. Joined Faireys in 1946.*

H. MEREWETHER (Hunter F.6): *Joined Hawkers in 1954 and serves as a production test pilot. Trained with R.N. as pilot till end of the war; started flying again on joining 615 Sqn. R.Aux.A.F. Has flown Furies, Vampires, Attackers and Meteors. Spent five years in Vickers-Armstrongs research department and has an engineering B.Sc. degree.*

P. MOORE (Bristol 173 and Sycamore): *Served as fighter pilot during the war and in 1946 joined Cambrian Air Services, later becoming chief pilot. Joined Pest Control, Ltd., in 1948 and converted to helicopters. With Bristols from 1953, flew Sycamore on demonstrations in Germany and Austrian Tyrol last year and on charter work with A.N.A. in Tasmania this year.*

R. MORRIS (Gannet A.S.4): *Served with the R.A.F. from 1943-44, then transferred to R.N. until 1950. Recalled six months later and served as pilot and deck-landing control officer till 1952, when he joined Faireys. In 1953 completed No. 12 course at E.T.P.S.*

M. MORSS (Javelin): *Joined Glasgow U.A.S. in 1947, and the R.A.F. three years later. Subsequently went as technician to A. and A.E.E. Before joining Gloster Aircraft in 1955 flew for some years with 615 Squadron, R.Aux.A.F. His flying time is rather over 1,300 hours.*

Lt.-Cdr. J. G. P. MORTON (Ultra Light Helicopter): *Entered R.N. 1943. Flight Commander 1835 Sqn. in 1944-45. Served in H.M.S. Colossus and Theseus. In 1949 became Flight Commander, Helicopter Flight, Underwater Development Establishment. Attended C.F.S. and later A. and A.E.E. In March 1955 was lent to Faireys from H.M.S. Centaur. Joined the company as test pilot soon after.*

S. B. OLIVER (Pembroke and President): *Served in R.A.F. and was commissioned in 1945. Took short-service commission with Air Branch, R.N. in 1945. Attended Central Flying School for instructor's course and, later, went to E.T.P.S. Was a naval test pilot at A. and A.E.E. from 1951-52. Released from Navy in 1954 to join Hunting Percivals.*

G. R. I. PARKER, D.F.C., A.F.C., D.S.M. (Beverley): *Experimental pilot at Brough, having joined R.A.F. in 1934. Was with 219 Night Fighter Sqn. in 1944 and a year later became test pilot at R.A.E. Joined General Aircraft in 1948, and more recently carried out first flight of H.P.88 at Brough.*

A. J. PEGG, O.B.E. (Bristol Britannia 101 and 301): *Bristol chief test pilot since 1947. Learned to fly in 1925 and served with 43 Sqn. as instructor. Appointed test pilot, A. and A.E.E. 1930; became assistant chief test pilot in same year. Was pilot of the Britannia during American tour in August.*

G. H. PIKE (Heron): *Was apprenticed to de Havillands in 1934. Joined R.A.F. Reserve in 1936, and the R.A.F.V.R. in 1938. Was commissioned in 1939, became a test pilot with the Engine Company in 1940 and two years later transferred to the Aircraft Company, and is now experimental test pilot.*

R. PLENDERLEITH, D.F.C. (Sperrin): *Joined R.A.F. Reserve in 1937 and the R.A.F. in 1939. After taking part in the Battle of Britain served in the Middle East and later in Italy. Has been a test pilot with de Havilland Engine Company since 1947.*

S/L. R. L. PORTEOUS (Auster trainer): *Chief test pilot and sales representative of Auster Aircraft. Learned to fly in 1935 at D.H. From 1937 was in R.A.F.O., and with Phillips and Powis (Miles) Aircraft from 1938-39.*

B. RADLEY (Pembroke and President): *Has been Hunting Percival test pilot since 1953. Was night fighter pilot with 125 Sqn. during the war, and became R.A.F. test pilot in 1946. Took No. 8 course, E.T.P.S., in 1949 and was experimental test pilot at R.A.E. for two years. Flew with Sabena for six months before joining the company.*

S/L. M. RANDRUP (Scorpion-Canberra): *Before the war was a charter pilot, joining R.A.F. as instructor in 1940. In 1942 was fighter pilot in Spitfires. Since the war has been test pilot in industry and at R.A.E. Has been Napiers' chief test pilot since 1946 and has 4,500 hours.*

K. REED (Sheerer): *Has been Saunders-Roe test pilot since 1952. Served in R.N. 1941-49. Formed and commanded R.N. Helicopter Squadron No. 705. Took helicopter course in U.S.A., 1943, and qualified as only R.N. helicopter instructor. Joined Westlands in 1949 as test pilot. Carried out first passenger helicopter service London-Birmingham in 1951.*

H. C. ROGERS, D.F.C. (Rolls-Royce-engined types): *Joined R.A.F. in 1938 as aircraft apprentice. Trained as pilot in 1941 and flew Lancasters on operations. Served also with Transport Command before leaving the Service. Appointed C.F.I. Tollerton Airport until joining Rolls-Royce in 1948.*

G/C. R. G. SLADE (F.D.2): *Was commissioned in R.A.F. in 1933 and was a test pilot at A. and A.E.E. in 1937-39, and continued there after Establishment moved to Boscombe. Subsequently served with Fighter and Bomber Commands and in British Air Forces of Occupation until taking up present appointment as chief test pilot at Fairey Aviation Company in 1946.*

THE DISPLAY PILOTS . . .

J. C. SQUIER (Canberra P.R.9): *With the R.A.F. from 1939 and served in Fighter Command during Battle of Britain. Posted to Maintenance Command as a test pilot in 1941 and remained there until 1946 when he joined English Electric. Has flown 64 different types, including 1,100 hr in Vampires. Now chief production test pilot.*

CAPT. R. SMITH (Pioneer): *Joined the R.A.F. in 1941. Became a senior captain with Scottish Airlines and is now test pilot with Scottish Aviation. Has over 8,000 hr flying time.*

H. E. STATHAM (Bristol Britannia 101 and 301): *Joined Bristols in 1940 as pilot at Yatesbury, transferring to test staff at Weston shadow factory in 1943. Handled production testing of Beauforts and Beaufighters, moving to Filton in 1945. Learns to fly at Heris and Essex Aero Club and became instructor there. Has over 5,000 hr, including considerable number on Britannias.*

J. W. STILL (Victor B.1): *Recently joined Handley Page as test pilot. Has some 3,000 hr on 50 types. Joined R.A.F. in 1940 and served as fighter pilot in Britain, Middle East and India. Became test pilot with Brooklands Aviation in 1950 and went to English Electric two years later, demonstrating Canberras at Farnborough for the past two years.*

S/L. E. A. TENNANT, D.F.C. (Gnat): *Qualified as pilot in R.A.F. in 1941 and served with both 256 and 257 Sqns., operating over Northern France from south coast bases. Served in France with 257 Sqn. until 1945. Posted to 84 Group Communications Squadron in Germany, and from 1946 to 1948 was at the Air Ministry. Attended E.T.P.S. and A. and A.E.E., joining Follands in 1950. Has flown nearly 100 different types.*

E. B. TRUBSHAW (Valiant): *Has been deputy chief test pilot of Vickers-Armstrongs (at Weybridge works) since 1950. From August 1946 to December 1948 was pilot of the King's Flight. Was later on the staff of Empire Flying School, Hullavington, and thereafter on the staff of the R.A.F. Flying College.*

L. P. TWISS, D.S.C. (F.D.2): *Has been test pilot since 1946. Joined Naval Air Arm, 1939. Carried out night fighter evaluation in U.S.A., and attended E.T.P.S. From there went to A. and A.E.E. Has taken part in deck-landing trials of all Fairey aircraft since 1949. Holder of world's speed record of 1,132 m.p.h. established in the F.D.2 last March.*

P. VARLEY (Javelin 7): *In 1941 joined Glasgow U.A.S. and went to U.S.A. for training in 1942. Served in Far East and Singapore with 99 Sqn. until leaving R.A.F. in 1947. He rejoined in succeeding year and served with 19 Sqn. Before joining Glosters early this year, attended C.F.S. course, instructed at No. 1 F.T.S., went on course at E.T.P.S. and served with "A" Sqn. at A. and A.E.E. Has flown 58 types and logged 2,600 hr.*

P. M. R. WALTON (Sea Hawk FGA.6): *Was flying instructor in the R.A.F. during the war. Attended Birmingham University afterwards gaining B.Sc. Joined Armstrong Whitworths in 1953, and served in design office until appointed test pilot. Until recently commanded 605 Squadron, R.Aux.A.F.*

R. G. WHELDON, A.F.C. (Jet Provost): *Was at No. 10 Flying Training School in 1956. Served with the R.A.F. from 1936 to 1947. He joined Hunting Percival Aircraft in 1947, and became their chief test pilot three years later. Has flown at several previous S.B.A.C. displays.*

S/L. L. M. WHITTINGTON, A.F.C. (Gnat): *After joining R.A.F. in 1942, went to Canada, and was later posted to Coastal Command. Became an instructor on Lancasters at 236 O.C.U., and went to E.T.P.S., 1950. Served at A. and A.E.E. and tested Canberras. Holds London-Karachi and London-Darwin speed records in Canberra P.R.3. Joined Follands in 1955, and has logged more than 3,000 hr.*

J. I. WILLIAMSON (Bristol 173 and Sycamore): *Loaned by R.A.E. to the company in 1955 and joined staff in 1956. Entered R.A.F. in 1939, served with 501 Sqn., in U.S. carrier Wasp, with Spitfire squadron in Malta and Mustang squadron in Italy. Attached Army Glider Pilots' School in 1946 and started instructor's course at C.F.S. in same year. Has over 4,000 hr in 38 different aircraft types.*

J. W. WILSON (D.H.110): *De Havilland assistant chief test pilot, having joined company in 1948. Served in R.A.F. from 1942 and was flying instructor 1943-44. In 1945 served with Tactical Air Force, Far East, and joined Central Fighter Establishment two years later.*

P. R. D. WILSON (Bristol 173 and Sycamore): *Served in the Army during the war and qualified as A.O.P. pilot. Was M.o.S. helicopter test pilot before joining Bristols in 1952. Has flown the Sycamore in Malaya and toured Sycamore units in the Middle East earlier this year.*

H. H. WOOD (Beverley): *Learned to fly in 1925 at Filton. Joined Hillman's Airways in 1930 and was first connected with General Aircraft in 1935. Flew Monospar to Australia and during flight was reported missing in the Timor Sea. Became chief test pilot at Brough on amalgamation of Blackburns and General Aircraft and has carried out maiden flights of prototype Beverleys.*

G. WORRALL (Javelin T.3): *Chief production test pilot of Glosters. After joining R.A.F. in 1941, completed training in South Africa and served with 81 Sqn. in Middle East and Far East. Then joined 60 Sqn., serving in Java, Malaya and Singapore. Joined Glosters in 1948 and instructed Belgian, Danish, Dutch and R.A.F. personnel on Meteors. Flew with 616 Sqn. R.Aux.A.F. at weekends. Has over 2,000 hr on 26 types of aircraft.*

ALSO FLYING

(The following additional names are notified as we go to press)

D. LOCKSPEISER (Hunter): *Served with the R.A.F., before which he was for two years with A.W.A. Joined Hawkers in May 1955.*

T. D. LUCEY (Hunter): *Served in both R.N. and R.A.F. during war. Instructor No. 1 Naval Fighter School, 1945-46.*

H. PARTINGTON (Scorpion-Canberra): *Trained as R.N. pilot, was in A.T.A. during the war, then successively flying for Lockheed, Rolls-Royce, Dominican Republic (instructor), Shorts and Napiers. Has 4,380 hr.*

W. H. SEAR (Widgeon): *Westland chief test pilot. Served in R.A.F. 1942-45, then Fleet Air Arm. Naval instructor with R.A.F., and in 1951 attended E.T.P.S., afterwards posted to A. and A.E.E. Has flown 46 types.*

D. M. S. SIMPSON (Hunter): *Served in the R.A.F. before he joined Hawkers in late 1954 as a test pilot.*

J. B. WALES, O.B.E., D.F.C., T.D. (Shackleton M.R.3): *Transferred from Army to R.A.F. in 1936 and served as fighter pilot in India and the Far East. Was with Avros before and rejoined them in 1946 as production test pilot. In 1949 was appointed C.O. of 631 Sqn., R.Aux.A.F.*

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The ejection seat used by air forces of twenty–six nations

The Martin-Baker Patent Fully Automatic Light-weight Ejection Seat, Mark 4, is designed to function efficiently at all operating heights and speeds of which contemporary and projected aircraft are capable. This seat is most compact and weighs only 80 lb. when fitted with the telescopic 85 ft. per second gun. The remarkably low installed weight has been achieved by considerable design ingenuity.

The seat is fitted with the Martin-Baker Patent explosive hood jettison equipment, which enables the occupant to fire himself out of the aircraft with the operation of one control only. When fired, the hood is jettisoned by explosive jacks, followed automatically, a second later, by the ejection seat.

Martin-Baker Ejection Seats have been responsible for saving the lives of many airmen throughout the world.

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ENGLAND —— CANADA

1

Production in Progress

BRITISH AIRCRAFT ON THE LINE IN AND OUT OF DOORS

PARTICULARLY at this time of year the British aircraft industry is the target for criticism of its output. Many observers, especially those from America, temper their reports of the S.B.A.C. Display with the comment that the Farnborough shop window does not have much of a shop behind it.

This sort of talk is not only valueless as criticism but is factually incorrect. Our record of making aircraft—great numbers of aircraft—is one of which we can be proud. Let it not be forgotten that during World War 2 we made more aircraft per head of population than any other country has ever done; and at the present time we have many large factories in which output per head compares favourably with the average achieved elsewhere, not excluding the U.S.A. The much-maligned British workman is no idler, neither is he one whit inferior to his competitors in any respect—although, it must be acknowledged, he has less horse-power at his elbow than has his American counterpart.

He does, however, work a very full day, and an equally full week. Not for him the three-day stint and a four-day week-end, as is the unhappy lot of some in less prosperous industries. For this we can thank the skill of our design teams, who (sometimes, perhaps, fortuitously) continually produce the right product at the right time. Not for him, either, the spectre of imminent redundancy, except in isolated cases. Employment in the manufacture and repair of aircraft today exceeds a quarter-million; it has risen steadily since 1950, when the figure was but 148,000.

These pages afford a few glimpses of some of our production programmes. Sometimes it is possible to illustrate the shop floor itself; in other cases this is forbidden on security grounds. In every case the unbroken thread of production means a full wage packet and a satisfied customer.

1. Coming forward on the Vickers-Armstrongs line at Weybridge are high capacity Viscounts 802s for British European Airways.

2. Avro Vulcan B.1 bombers at Woodford. Vulcans will enter R.A.F. service on the conclusion of trials now in progress at the A. and A.E.E.

2

PRODUCTION IN PROGRESS

3

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4

3. *Bulking big, even in Handley Page's vast new assembly hall at Radlett, are Victor B.1 bombers, soon to enter R.A.F. service.*

4. *Hawker's great factory at Blackpool is the setting for this eloquent picture of Hunter fighter/bombers "coming through."*

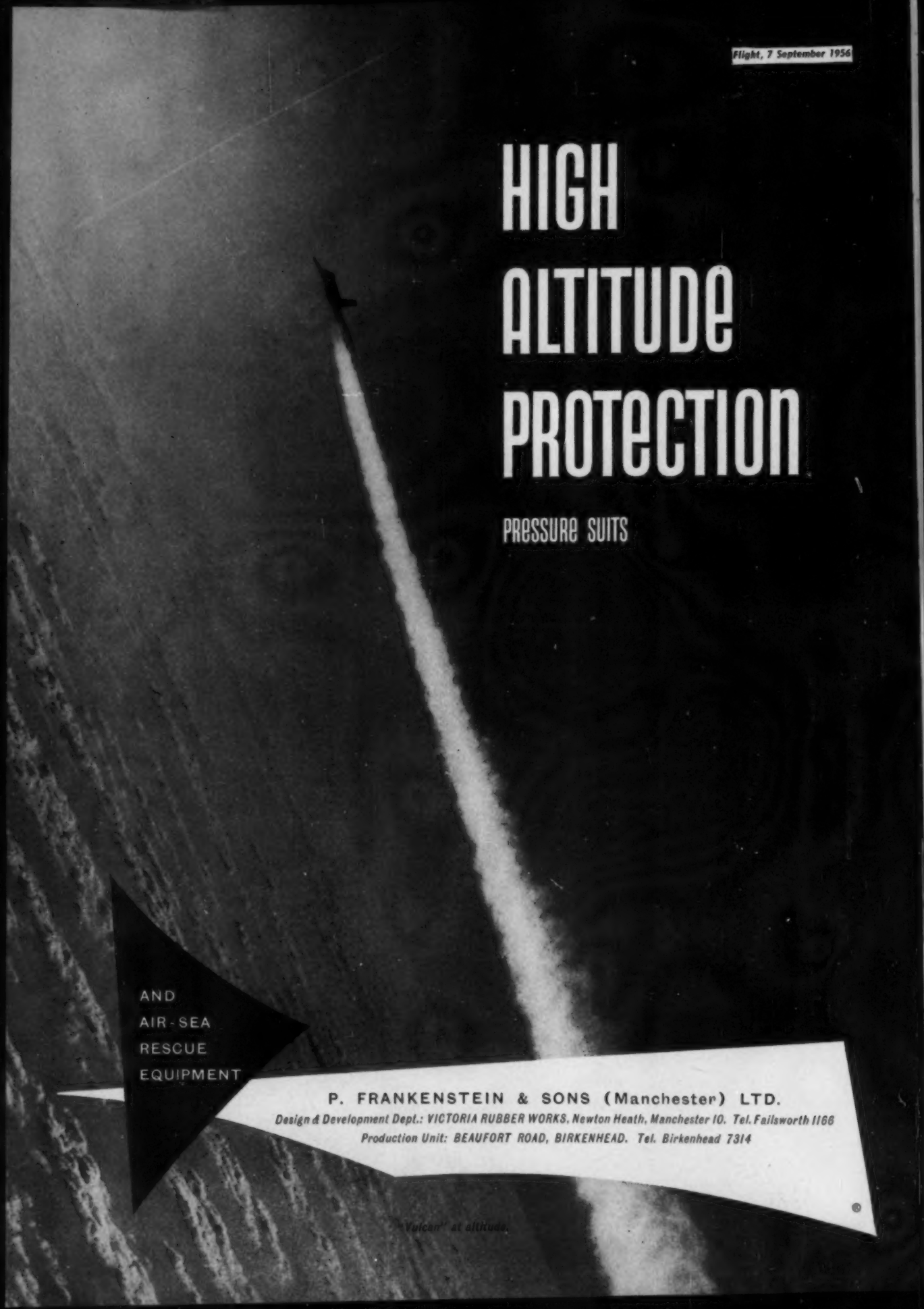
5. *de Havilland Vampire T.11 trainers are here in the hands of the Royal Air Force after delivery from the maker's Chester factory.*

6. *Bristol helicopter production is now concentrated at Weston, where these Sycamores are seen on the assembly line.*

7. *A single A.O.P.6 terminates a line-up of A.O.P.9s at the Rearsby airfield of Auster Aircraft, Ltd.*

6

7



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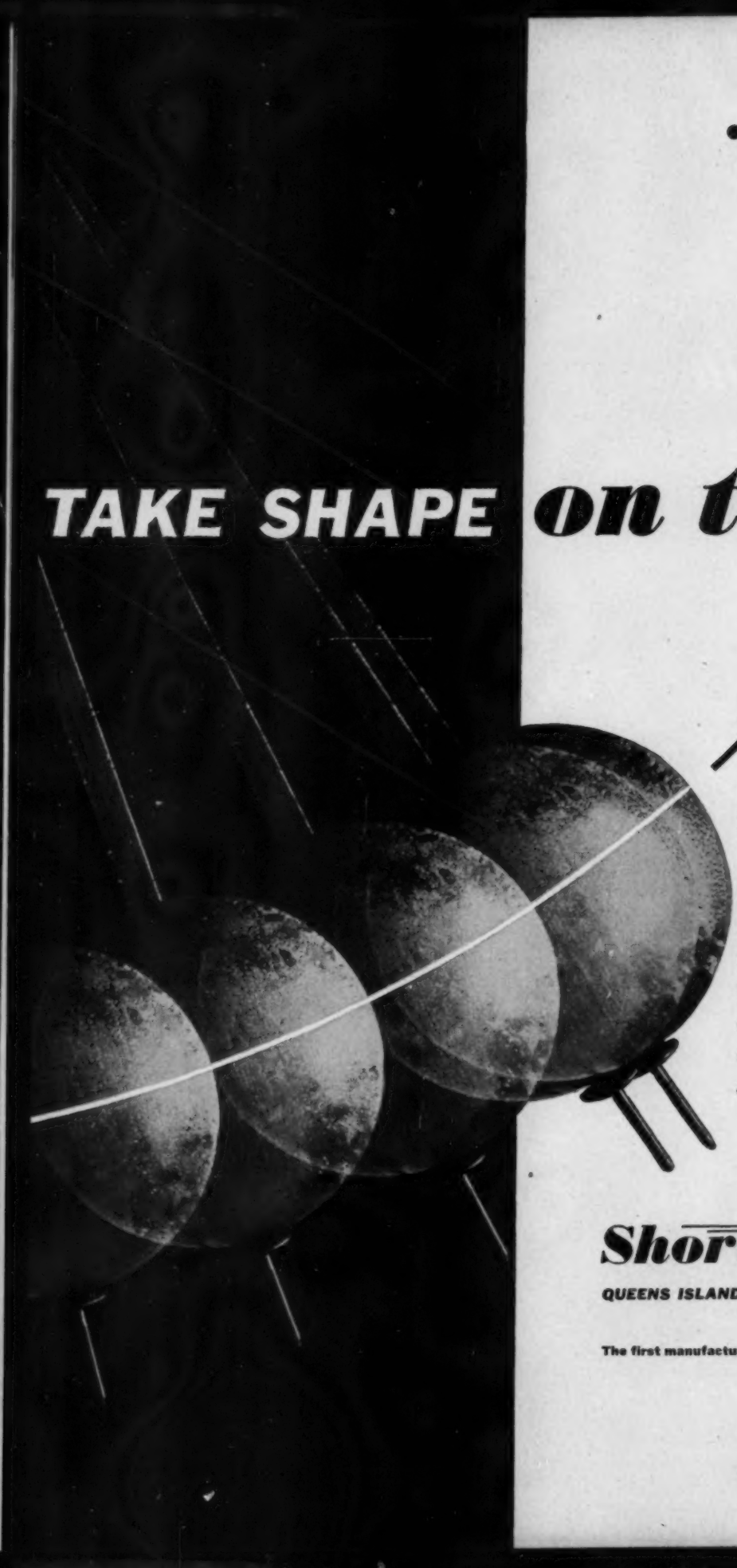
Production Unit: BEAUFORT ROAD, BIRKENHEAD. Tel. Birkenhead 7314

"Vulcan" at altitude.

Flight, 7 September 1956



● Shorts have a reputation for on-time delivery. That matters in any industry. In the aircraft industry it is vital. To achieve that reputation requires resources—resources of space, equipment, labour, power; resources of organisation and skill at every level. To keep it requires far-sighted planning.

TAKE SHAPE *on time*

At this moment, Shorts are creating even more space for the Bristol Britannias being built at Belfast. This factory in Northern Ireland, probably the largest of its kind in Europe, has series production of these £1,000,000 giants well under way. It is part of a great expansion programme at Shorts that takes in design, research and testing as well as production. Every section of Shorts is contributing to the growth of this comprehensive production unit. Shorts have a reputation for on-time delivery. They propose to keep it.

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8

9

PRODUCTION IN PROGRESS

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11

8. *Hunting Percival Pembroke C.1s for the R.A.F., with a Provost T.1 trainer, in the shops at Luton.*

9. *Production of Fairey Gannet anti-submarine aircraft at Hayes—a picture by our associated journal "Aircraft Production."*

10. *In the sun at South Marston are Vickers-Supermarine Swift fighter and fighter/reconnaissance aircraft.*

11. *A recent picture from Preston, showing tests in progress on the noses of English Electric Canberra B(I).8 intruders.*

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PRODUCTION IN PROGRESS

12. *The historic airfield at Weybridge is the scene; Vickers-Armstrongs Valiant B.1 bombers for the R.A.F. are the aircraft.*
13. *Whirlwind helicopters in the erecting shops at the Westland Aircraft factory, Yeovil. A Dragonfly is in the foreground.*
14. *Twin Pioneer short-take-off transports well advanced at the Prestwick works of Scottish Aviation, Ltd.*
15. *Hall of giants: long-range Bristol Britannias at the Queen's Island (Belfast) works of Short Brothers and Harland, Ltd.*

15

Assembly of a Javelin Junction box at Plessey. Photograph by courtesy of the "Times Review of Industry."

Yet another example of The Plessey Company's specialised capacity for the production of Aircraft preformed wiring. This is but one aspect of Plessey Service to the aircraft industry.

Plessey *preformed wiring assemblies*

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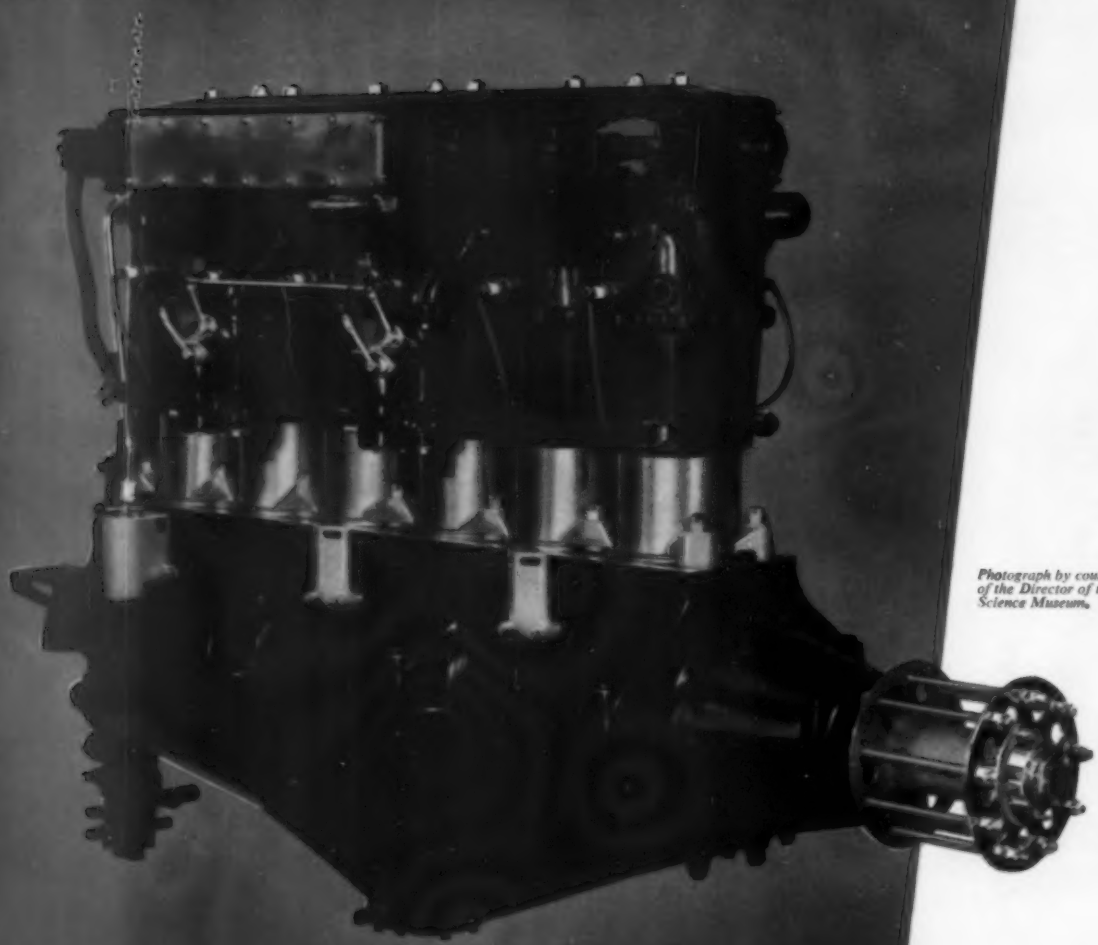

Photograph by courtesy of the Director of the Science Museum.

ON AUGUST 4th, 1914...

. . . the gathering storm of World War I broke. In the air a chapter of history was written which neither time nor the impact of another World War have dimmed. When the Great War broke the R.F.C. possessed about 100 aeroplanes, 3 airships and a personnel of some 1,250 men. At the end of the war the R.A.F. had over 22,000 'planes, 103 airships and a personnel of nearly 300,000. Great names emerged—Mannock, Ball, McCudden, Barker —and we recall with pride and affection the 'planes they flew—the S.E.5, the Sopwith Camel, Sopwith Snipe, the Bristol Fighter—and the D.H.4 designed by Captain Geoffrey de Havilland with a 240 B.H.P. engine.

When the B.H.P. (Beardmore, Halford, Pullinger) was produced in quantity by the Siddeley-Deasy Company, it was known as the "Puma". It was a six-cylinder water-cooled engine giving 246 b.h.p. at 1,400 r.p.m. and weighing 625 lb., the bore and stroke being 145 mm. and 190 mm. Twin Zenith carburetters were employed, and for the dual ignition system a Fellows E.M.6 type magneto and small 6-volt battery with Remy combined contact breaker and distributor.

1914-1918 was one of the great 'milestones' in the evolution of the aero-engine. From virtual non-existence a flourishing industry sprang up. Fine engines like the Lion, Jupiter, Jaguar and Eagle established such names as Napier, Bristol, Siddeley and Rolls-Royce in the front rank of aero-engine design and manufacture.

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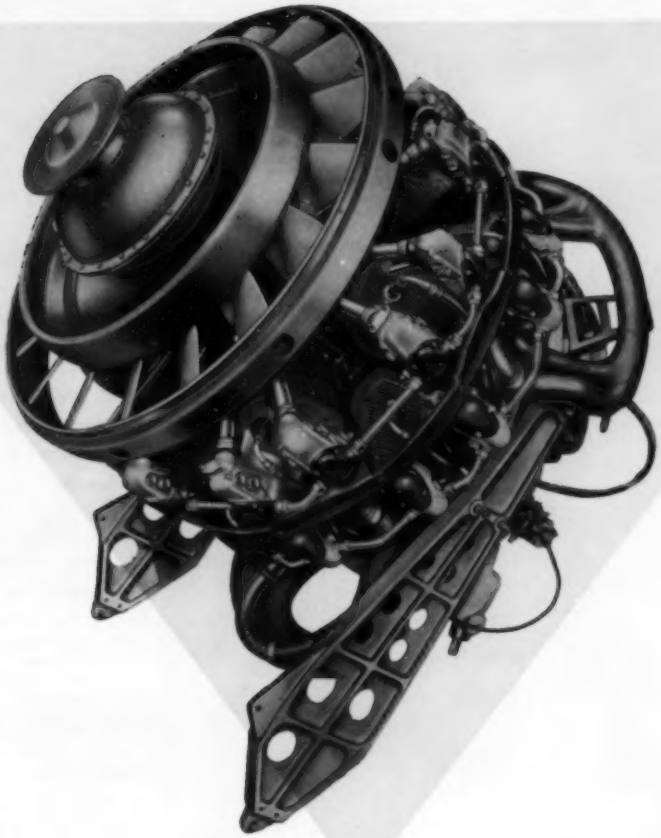

ALVIS Leonides MAJOR 870 b.h.p.
The power plant for the
Westland - Sikorsky
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ALVIS Leonides MAJOR

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Heralds *would improve the picture*

in Kandahar

These Afghan growers bring their fruit to a big market—millions of pounds' worth is sold abroad yearly. This means a great deal in a land where modern industry is not advanced.

From Kandahar comes fresh fruit in varied profusion. Mulberries, pomegranates and quince grow and ripen in valley orchards and gardens alongside cherries, figs, apricots and peaches.

Carefully packed in baskets, this fruit may come to market over stony tracks, a donkey's burden. Pack animals are indispensable in a country of forbidding terrain where means of transport are limited.

Yet speed is important when such perishable goods are on the move.

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Heralds, using small, simply equipped airstrips, could do the work here better than any other aircraft.

for **9** *good reasons*

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- **Reliability: strongly and simply built for long life and easy maintenance.**
- **Performance: meets world-wide flight requirements with a clear margin in hand.**
- **Versatility: passengers, freight or a mixed load up to 11,000 lb.**
- **Economy: costs less than 1¾d. a passenger-mile and less than 18d. a ton-mile to run.**
- **Small airfields: can take off with full payload from 1,000-yard grass landing-strips up to 5,000 feet.**
- **Cruising speed: 221 m.p.h.**
- **Pressurisation: efficient and comfortable travel up to 20,000 ft.**
- **High wing: easy loading and a good view for passengers.**

HANDLEY PAGE RADLETT · LONDON · READING

16

PRODUCTION IN PROGRESS

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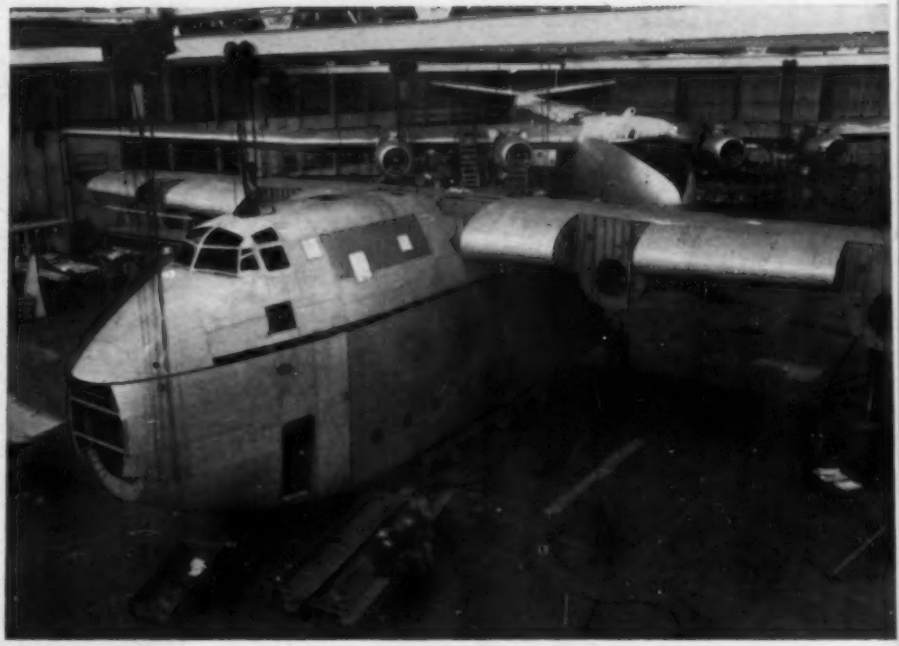
16. *Another aspect of the Queen's Island works of Shorts, depicting Seamew light anti-submarine aircraft in production for the Fleet Air Arm and R.A.F. Coastal Command. Beyond are English Electric Canberras and Bristol Britannias.*

17. *"Like taking a photograph inside a tin of baked beans," was the comparison drawn by Blackburn and General Aircraft's publicity manager, from whom we solicited a picture showing production of Beverley C.1 heavy transports at Brough. But here two of the monsters are seen to advantage.*

18. *Cleared from Glosters Moreton Valence airfield are these two Javelin FAW.1 all-weather fighters, bound for a squadron of Fighter Command, Royal Air Force.*



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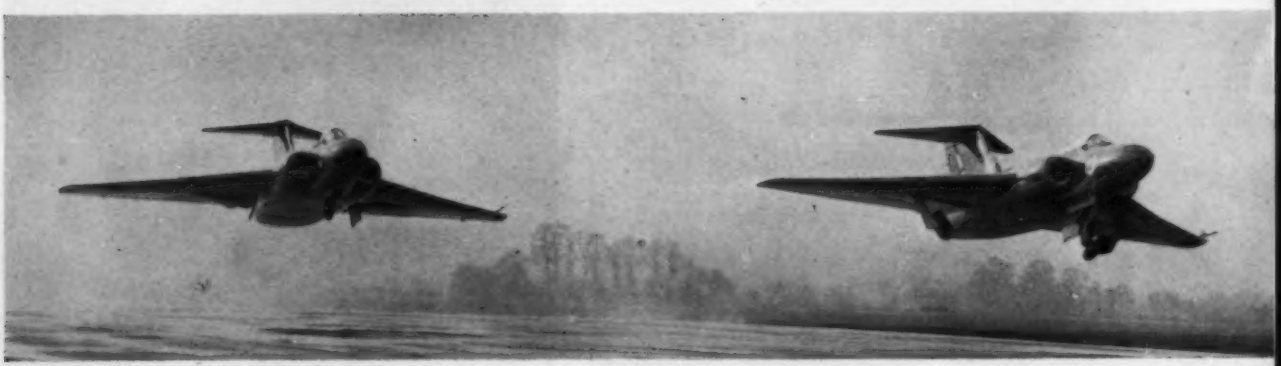

H

Men behind the Farnborough show, Mr. E. C. Bowyer, C.B.E., director and chief executive of the S.B.A.C. (seated), and Mr. H. W. Goodinge, A.R.Ae.S., an assistant director, discuss a point of organization.

"Flight" photograph

BACKGROUND to FARNBOROUGH

Organizing the S.B.A.C. Show

AT some time during the first Sunday in September, the genial ghost of "Colonel" S. F. Cody surely tethers his white horse to that famous dead tree at the north-east end of Farnborough's main runway, thoughtfully removes his Stetson, then starts to puzzle out just what so many queer shapes of flying machines, so many tents, so many people and so many motor cars are doing on that comparatively deserted area known as Laffan's Plain over which he flew precariously fifty years ago.

The pioneer's bewilderment would be justified: there was, of course, nothing like the Society of British Aircraft Constructors' Display and Exhibition in his day; in fact, it has only existed in its present form since 1948. And were Cody curious to discover just *how* it comes into being each year, he would have to question not only the S.B.A.C. (whose officials do the lions' share of organizing this vast and superlative air show) but also the Ministry of Supply, through whom the Royal Aircraft Establishment's land and facilities are rented to the S.B.A.C. for the occasion.

No one who goes to Farnborough nowadays, either on business or for sheer pleasure, can fail to wonder at the amount of organization involved by the great display which has burgeoned from what was (by comparison) almost a private flying demonstration at Hendon in 1932. Nor should visitors fail to be grateful for all that is done so unobtrusively but efficiently by the S.B.A.C. and the R.A.E. staffs concerned.

Planning for Farnborough—as the Show has popularly come to be known—starts amid February fogs and frosts, eight months in advance, at the S.B.A.C.'s airy new offices in King Street, St. James's, London.

The Society's Council, basing their judgment on recommendations by their Sales and Exports Committee, decide whether they are going to hold another display; where it should be and when; and whether the public should be admitted.

Once these decisions have been taken (and provided the answer to the first question is "yes"), the actual business of organization is left in the experienced hands of Mr. E. C. Bowyer, director and chief executive of the S.B.A.C., and Mr. H. W. Goodinge, his right-hand man and an assistant director of the Society. (Their experience of running these displays goes back to 1932.) From then until after the first full week of September, their lives—and those of many other people involved in Farnborough—are scarcely their own.

Consider the problems they have to solve, in terms of a military operation: (a) To assemble at airfield *x* a flying and static exhibition representative of Britain's latest aeronautical achievements; (b) to arrange a flying programme in which approximately 36 fixed-wing aircraft and eight helicopters, varying widely in size and speed, show off their individual paces in a two-hour display; (c) to allocate stands between over 300 exhibitors on 113,000 sq ft of floor space; and (d) to provide catering and all other requisite facilities for upwards of 200,000 people a day at peak times.

S.B.A.C. shows then and now: twenty-three years' aeronautical progress is illustrated by these pictures. On the left, the second S.B.A.C. display, held at Hendon in 1933 (photographers were not allowed at the first). From the gunner's cockpit of a Handley Page Heyford can be seen an early Percival Gull, a D.H. Fox Moth, a Spartan Cruiser, behind it a Spartan Clipper, and other aircraft. On the right, at Farnborough last year, with the Vulcan, Victor and Comet 3 taking pride of place.

"Flight" photographs

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BACKGROUND TO FARNBOROUGH . . .

This involves, to say the least, some complicated planning—both at the S.B.A.C. headquarters and also at the R.A.E., whose normally routine and reasonably secluded existence is disturbed some months before the show by an advance guard of contractors who invade and occupy the other side of the airfield.

One of the first steps in S.B.A.C. organization is the circularizing of members, asking them for information on what they are going to exhibit. When the probable contents of the static show are known, places in the exhibition hall are allotted by ballot. As far as the aircraft which are to fly are concerned, a very careful selection is made. The qualifications of the new machines have to be assessed from the technical, engineering and sales points of view; the number which can be demonstrated is restricted by the amount of time available for the flying display.

Meanwhile, the physical task of transforming Farnborough from a (comparatively) peaceable airfield to something between Royal Ascot and Coney Island, is being put in train by the contractors.

Certain permanent facilities now exist on the exhibition site, such as drainage, an electric sub-station, and terraces (which have been constructed during the past winter); but the tented town which covers stands, restaurants, bars and other necessities of life has to be erected (and, as soon as September 9 is over, silently folded away). Catering arrangements have to be made, for eating and drinking are part of business (and certainly part of looking at aeroplanes. The writer can recall few higher pleasures in life than cogitatively consuming a hot-dog on the hill at Farnborough while watching Zurakowski's sublime convolutions in a CF-100). Ten thousand meals are served during show week by the exhibitors' restaurant alone; hot-dogs, ice-creams, minerals and other forms of liquid welfare are engulfed by the thousand.

While the stage is being set at Farnborough, detailed aspects of the flying programme are worked out by the S.B.A.C. and the R.A.E. in conjunction. Consideration is given to each type of aircraft and its speed; its place in the display and duration of demonstration (on the average five minutes, though the time ranges from three to eight minutes) are allotted accordingly. Diversion airfields (Odiham and Blackbushe) have to be arranged with the Air Ministry; for any pilot who overstays his time in the air must make himself scarce so as not to disrupt the rest of the programme.

Actual control of flying on the afternoon of the show comes under the jurisdiction of G/C. David McKinley, who is C.O. experimental flying at the R.A.E. Each pilot has to file a flight plan of his intended programme. Among the officials to whom copies are passed is the commentator, Oliver Stewart, so that he can keep spectators abreast of the swiftly moving pattern of jet flying.

The Farnborough control tower—nerve-centre of the S.B.A.C. flying display and the model for flying control installations—seen as background for a Sea Hawk.

Meanwhile, too, the S.B.A.C. has to decide whom to invite as official guests. There is now a permanent guest list, which grows rapidly larger from year to year and, broadly speaking, includes everyone who is in a position to influence potential purchasers of the products of the industry. This list has "just growed" in quite phenomenal fashion. In 1948 a modest total of 14,000 invitations was issued at home, and 800 overseas; but by last year these figures had leapt to 48,000 and over 6,000 respectively. The guests include Government officials, air, navy and army chiefs, and airline executives from the U.K. and all points abroad. A traditional part of Farnborough week is the banquet at the Dorchester Hotel, attended by nearly 900 guests on the Monday evening; this itself requires no small amount of organizing.

Another matter which has to be dealt with is publicity. Though no air-minded person nowadays needs reminding that Farnborough occurs in the first full week of September, the annual poster announcing the display puts British aviation well on the public advertising map, amongst the toothpastes, foods and cigarettes which are our staple visual diet on hoardings. This poster was thought out jointly by Mr. Bowyer and Mr. Goodinge. The latter, a talented amateur artist whenever he finds time to practise, sketched out the original design.

Another necessary form of publicity is the printed programme. For this, S.B.A.C. members must send in their entries by May 30, though modifications (inevitable owing to production and other difficulties) may be made right up to the end of August.

During the pre-Farnborough period, member-firms face the problem of getting their own products ready and (in some cases) keeping up deliveries to other firms which are essential if they, too, are to participate. As September draws near, the urgency of demands grows greater, for Farnborough is an international shop-window displaying its goods but once a year.

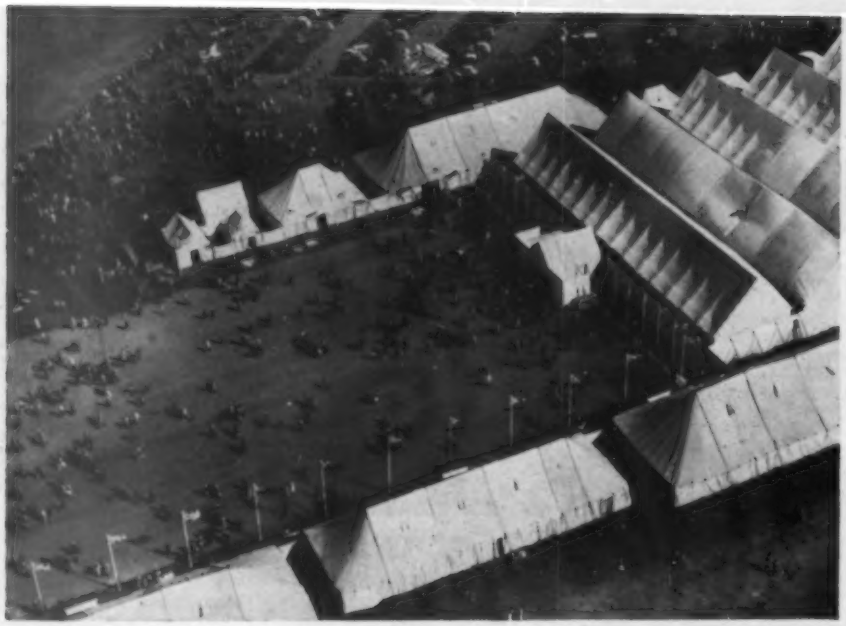
At the site itself, the original advance guard of contractors has now grown to a constructional army nearly 300 strong; and the pattern of the tented town, with its vast car parks, familiar to each display pilot as he turns back from take-off for his low downwind pass along the line of the runway, is beginning to take shape. Around Farnborough the local constabulary have been reinforced in readiness to direct the tide of motor vehicles which will flow in from all sides at peak times to the extent of 4,000 an hour.

At the S.B.A.C. offices information is now coming in (or should be) to enable the programme to be completed. Arrangements are made with the Ministry of Transport and Civil Aviation for a *Notice to Airmen* to be published, warning civil pilots what is likely to be happening in the Farnborough air; servicing facilities for the participating aircraft have to be arranged with the R.A.E., in addition to those provided by the manufacturers themselves; so have ambulances and crash services, and marshalling and towing facilities.

With the broad outline of the coming Display and Exhibition thus thoroughly planned and put in train, a multitude of small details remains to be tied up. Though information about exhibits on stands has all been given to the S.B.A.C. by the end of May, data on aircraft to be flown has to be received up to a much later date, because of their comparative unpredictability. Thus the flying programme goes to press much later than the one for the

"Flight" photograph

On left, the building where most of the planning for Farnborough is done. The S.B.A.C.'s handsome new headquarters (into which they moved last December) in King Street, St. James's, London.



Pilot's eye view of the Farnborough crowds—and of part of the tented exhibition hall, which is the largest structure of its kind in the world.

BACKGROUND TO FARNBOROUGH . . .

static exhibition, and the running order of display itself may have to be amended if an aircraft is withdrawn at the last minute.

Meanwhile, arrangements have to be made with the G.P.O. for telephone and postal services to be laid on, and with a bank which provides on-the-spot financial service. (It is not unknown for a buyer to make an over-the-counter purchase of one or more aircraft, though usually the business results of a visit to Farnborough appear during the weeks or months following.) Arrangements have to be made for manning entrances and car parks, and for providing first-aid facilities. And here it is interesting to note certain divisions of responsibility between the S.B.A.C. and R.A.E., for while the S.B.A.C. puts up the barriers to mark spectators' areas, the R.A.E. arranges for fire and medical services, including British Red Cross teams and provision of beds at local hospitals should these be required.

All the time in the weeks preceding the show, telephone lines to Trafalgar 3231 (S.B.A.C.) and Gerrard 6933 (M.o.S.) are hot with enquiries from potential participants, wanting to know if they can do this, that or the other. Many of the aircraft on view are M.o.S. property, so permission must be asked to display them; and for their part, the Ministry must decide what the general public (and the world at large) may be *allowed* to see within the limits of national security.

All the time, too, the daily, weekly and monthly Press is in contact with the S.B.A.C. to find out "what's going to happen at Farnborough"—or what is not; and these endless enquiries are patiently and helpfully dealt with by Mr. Alexander Johnston and his Press Office colleagues. Telling the world what is going to happen at Farnborough is the next most important thing to seeing that it all *does* happen as planned.

As the months lessen into weeks, and the weeks into days, before the show, S.B.A.C. officials either spend most of their time at Farnborough, or rush back and forth over the 34-odd miles between there and London. At factories, the pace daily becomes quicker, in the inevitable rush to get aircraft, engines, or components, or parts for other manufacturers, ready for display. Test pilots rehearse their flying routines. Sales managers and publicity men arrange for the parking and stocking of the caravans which will provide each firm with a combined shop window, social centre and grandstand view of the display. At Farnborough itself, stands are erected (all to a standardized pattern laid down by the S.B.A.C.) in the vast tented exhibition hall, largest of its kind in the world, with 13 miles of standard width canvas for its roof alone; signs are put up, wiring laid. Across at the flying control building, the complicated routine of the air display is at last coming into final shape, and the controllers are briefed for their duties. At the dispersal points where the aircraft will be parked, enormous quantities of jet and piston-engine fuel are laid in. Security guards are organized to keep an eye on these hundreds of thousands of pounds' worth of valuable aircraft.

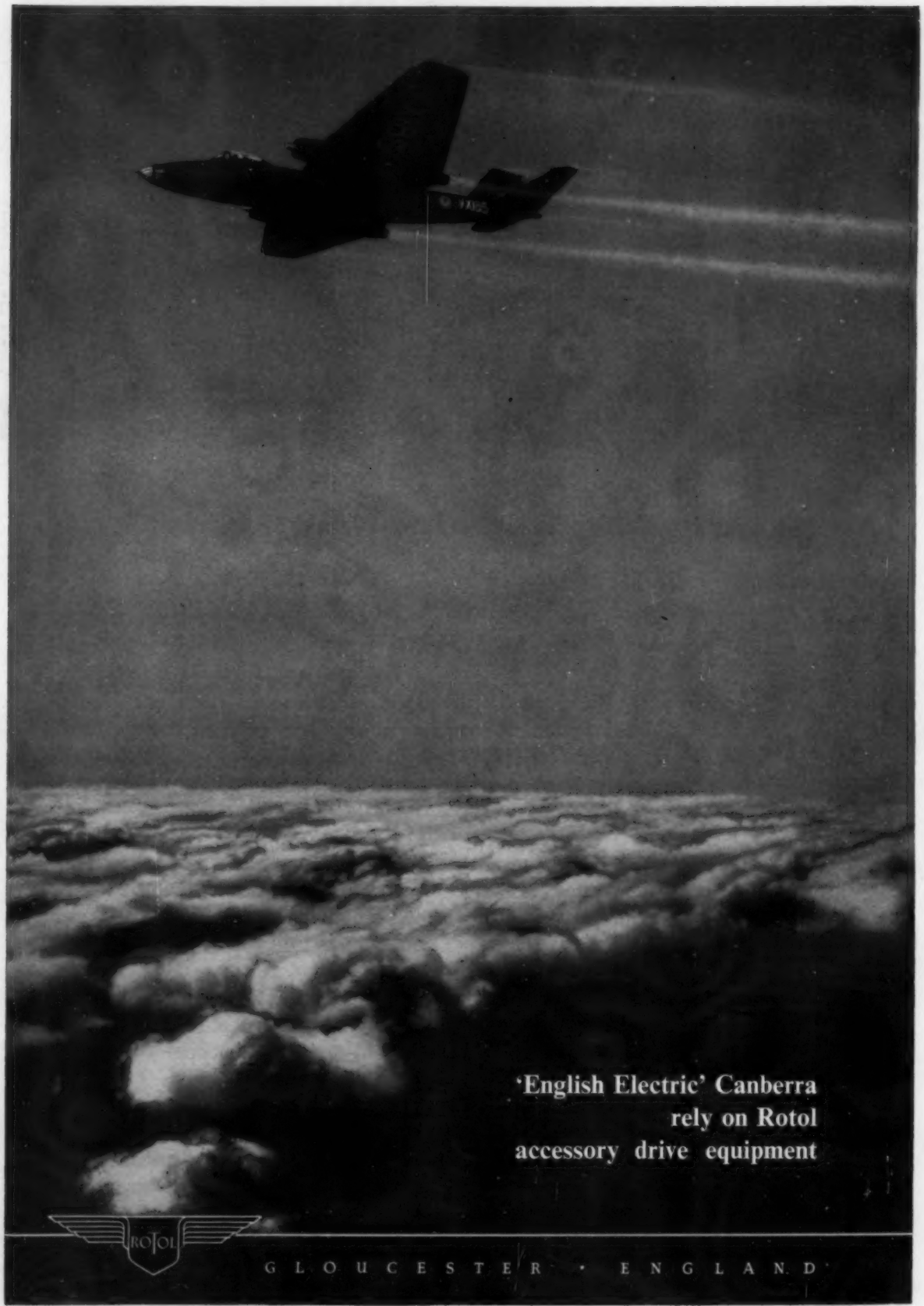
Meanwhile, routes to Farnborough are signposted with R.A.C. signs; public notices are put up at the airfield, including hopeful appeals not to drop litter; local bus services get extra vehicles ready for a V.H.F. shuttle service between the station and the airfield; British Railways organize their extra trains announced for the display week. Only one thing remains quite unpredictable and unorganizable—the weather. But the dates for the display were originally chosen because meteorological records show it to be at its most reasonable and well-behaved during the first week of September.

Gradually all static exhibits are delivered to Farnborough in the week before the show begins and are erected on their appropriate stands. A mobile crane is provided by the S.B.A.C. for unloading heavy exhibits. As the days become hours, food and drink stocks are brought in to fortify the hungry thousands; flowers and shrubs are positioned to beautify corners and gaps; paint brushes work miracles with colour; everything begins to acquire that permanent, solid look, as if it always had been there and always will be.

Then, without fanfares, the opening day arrives: months of intricate planning suddenly blossoms into another Farnborough. This unique compound of skill, daring, spectacle, creativeness, technical achievement, business sense and just plain good sociability, is "on" again for another year. The little Hampshire town whose name has gone round the world as a synonym for aeronautical showmanship sees the world stream down its roads to the Royal Aircraft Establishment. And it is to the R.A.E.'s staff, to M.o.S. officials, and above all to the organizing geniuses of the S.B.A.C. that we owe this annual microcosmic view of Britain's aviation achievements.

H.W.

How Farnborough "sells" itself to the public. This year's S.B.A.C. Display poster—a striking piece of publicity.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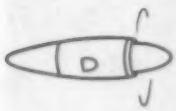
GIVE FOR THOSE WHO GAVE

THE ERA OF THE ELAND

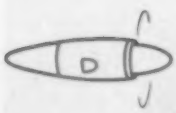
How many development hours is 'know-how' worth?



Why is the Eland ahead of its time? The answer lies years back—in the steady accumulation of engineering skill and experience that forms the 'Napier tradition'. This 'know-how' made us decide on the single-spool as opposed to the twin-spool—and at the same time showed us the way to find the compressor we needed.

In 1947 it was clear to us that only by basic research on stage matching could we find that compressor—one which would make possible a single-spool turbo-prop with the simplicity, the economy, the power and flexibility of the Eland.

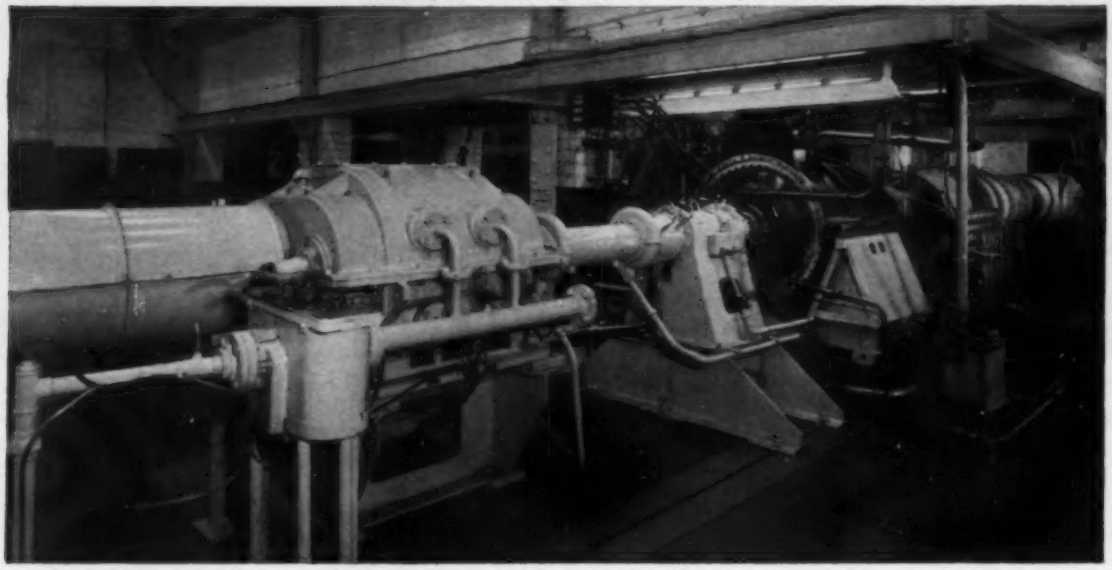
So we built at Liverpool the best-equipped gas-turbine research station in Europe. The original work we have carried out in that station has given us a knowledge of compressor problems—and their solutions—equalled by few other aircraft engine firms.



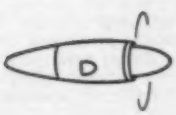
After thousands of hours of cascade work we determined by 1952 the right type of blade to use, its general aerofoil characteristics and the basic geometry of the compressor itself. Even at this stage, a very large number of possible compressors could have been built.

IS BEGINNING • • •

Compressor Test Rig: Gearbox and highspeed transmission, Napier Research Station.



We now had to make a vital decision. Which prototypes—out of this very large possible number—should we build? Theory wasn't much help here. We had to depend on 'Know-how' and the engineering sixth sense it gives. The right answer could save us thousands of hours of work—the wrong answer could put us back years.



It was decided that we should start by building four compressors. When we had built the third we knew we had what we wanted! By now we have been able to put in three years steady development work on the same blade/compressor combination.

With a type test at 3,060 e.h.p. successfully completed we can say now that the Eland's design is basically sound, basically right, and will not have to be fundamentally altered in the years ahead. The Era of the Eland is beginning with an engine of *proved* safety and flexibility.

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". . . sprayed the insect-killing lotions over the forest areas, leaving a white swirling trail behind him."

AN AIR WAR IN GERMANY

—against Forest and Vineyard Pests: Highlights of a Helicopter Spraying Tour

By JULY C. MYHILL

AMONG the activities of Overseas Aviation Ltd., whose H.Q. are in the Channel Islands, and who have a base in Germany, is the operation of a fleet of three Sikorsky S-51s on a variety of pest-destruction duties. This summer one of the aircraft was under contract to carry out extensive work in the Rhineland, under the management of Mr. Ronald Myhill, a director of the company. The tour provided some unusual problems and experiences, as related here by Mrs. Myhill. The majority of the photographs are by Wenk-Neuhaus of Nürnberg.

"OLD VICTOR" is becoming a familiar sight to Germany when the pest-control season opens early in the year. Farmers, fruit growers, forest owners and various authorities have long grown used to the rhythmic rotor din of G-AJOV with its wide spray-bars and 75-gallon belly chemical tank; and they accept cheerfully the inevitable cavalcade of tankers and other servicing vehicles that wends its way from landing site to landing site.

During the winter months, long before the helicopter begins its exacting task, the basis for each operation is worked out by the authorities concerned. For instance, the paths of the hibernating, root-eating cockchafer larvæ are determined by continually digging patches of the ground and counting their numbers. In this way, and by taking ground temperatures, the eventual places and times of break-out of the ever-ravenous insects are arrived at with unfailing accuracy. Edges of oak and birch forests are their favourite feeding-ground. Having emerged from the ground and settled in swarms, they can kill a grown, healthy tree within hours by devouring each and every vestige of foliage.

Pine-tree pests have even stranger habits: some of them appear in only one area at a time, and then assume dangerous proportions only once in about 25 years. Small, prettily coloured butterflies lay their eggs within the pine needles; and the emerging caterpillars—some 600-800 per tree, at first only a few millimetres long but growing to about two inches within three weeks of their life—will consume the pine needles with such speed that a tree is stripped bare and doomed to complete destruction within a day.

Though the tactics of vineyard pests may be more predictable, this field of control tends to be the most exacting of all, if only because of the infinitely high losses which failure may entail. A vineyard affected by the dreaded *Peronospora* to more than a certain small percentage has to be burnt out completely and left bare for a number of years before the next growth may even be started.

It took many long discussions to convince the authorities and individuals that control by helicopter is the only sure way to combat pests rapidly and with lasting success. Not only did we have to overcome the prejudice of the many who were clinging to the traditional methods, but we also had to be certain that our equipment and methods would meet their very sceptical demands. Nothing will make an old farmer, or an experienced wine grower, lose interest more quickly than having to listen to someone who doesn't know what he is talking about. We had to be familiar with chemical formulæ; to know the names and habits of at least the more common forms of pests; to know what to recommend in the way of chemical concentrations and mixture bases; in short—as in every new field of operation—it was like going to school all over again.

The demands were many and the problems often seemed unsurmountable. In vineyard work, for instance, the spray had to be so fine as to resemble molecules of fog, covering the leaves on both the upper and under sides; the chemicals used could not be concentrated strongly, because of burning effects during the summer months; and the speed of the helicopter had to be such that the young tender shoots would not suffer damage from the rotor downwash.

In forestry, for cockchafer work, the main object was to produce as wide a swath width as possible without losing insecticide

". . . the inevitable cavalcade of tankers and other servicing vehicles that wends its way from landing site to landing site."

AN AIR WAR IN GERMANY . . .

effectiveness, and, at the same time, to give complete coverage of the foliage without affecting the ground fauna. In pine woods the coverage had to be so fine and sufficient as to cover each and every pine needle; in orchards the chemicals were supposed to wash off the fruit easily, yet be sufficiently effective to prevent the flies from laying their eggs in the newly formed fruit.

We soon learned that the seemingly impossible had to be achieved in order to establish the overall supremacy of the helicopter, and our helicopter in particular, in these fields. The equipment originally at our disposal had to be altered and renewed. New pumps were installed to give a higher and more constant pressure; spray nozzles had to be exchanged for finer types, giving the minute droplet size required. Our technical staff were busily engaged during the winter in perfecting and improving every aspect of the system. Slow-motion films, made during some of the trial contracts we had undertaken during the previous year, showed all too clearly that our work was not yet perfect. Differences of such minute proportions of 3/20ths of a second in the fall of the spray before the downwash of the main rotor blades had to be allowed for, and the angle of the spray bar adjusted accordingly; from these films charts were drawn up indicating the "turn and bank" tendencies of branches and foliage, in order to assist us to approach perfection as closely as it was humanly possible. Tests were carried out, in the comparative seclusion of a quiet corner of our airport base at Frankfurt/Main, by laying literally miles and miles of paper strips and flying over them again and again at various heights, testing droplet sizes, swath widths, pump pressures, deliveries and the suitability of newly installed plastic tubing.

Late in April, because of the extremely cold spring, the first call came to begin the big operation against cockchafers in the thickly wooded areas of southern Rhineland-Pfalz and the hilly Eifel area in Western Germany, along the Rhine and Moselle. The spade work had been done. Dozens of landing sites had been carefully selected in the somewhat difficult terrain and marked and fenced, suitable spots usually being available in the form of village football grounds and recreation centres. The total area was about 15,000 acres, in two main districts of 9,000 and 6,000 acres respectively, and we had barely a fortnight in which to complete the operation successfully if good results were to be assured. The weather was not exactly ideal, and on some days flying could not take place at all because of low clouds and driving winds and rain.

The chemicals (D.D.T. compound and water) were mixed into a foamy white liquid and the helicopter's tank filled in 80 sec. Fuel was taken on in small quantities after every third or fourth landing in order to allow the largest possible disposable load for insecticide.

Hour after hour, with few but welcome breaks, *Old Victor* sprayed the insect-killing lotions over the forest areas, leaving a white swirling trail behind him. Lane upon lane could be flown easily without marking, but yellow flags were used to show the area boundaries.

The large-scale operational maps, duplicates of those held by the pilot, were checked constantly by the ground staff, and as soon as a part of the area was finished the machine was positioned to the next landing site, the caravan of trailers, trucks and cars, often a line of ten vehicles or more, following it along. Every night, back in the village hotel which was selected as the operational "headquarters," the amounts of chemicals used were checked against the areas reported to be covered; and, rather to everyone's surprise, they worked out perfectly, down to fractions of gallons.

The most encouraging feature of the cockchafer destruction, from our point of view, was the receipt of quick and regular success reports. As soon as 15 minutes after spraying, the insects begin crazy zig-zagging, then become paralysed and fall by their hundreds to the ground. Counts are taken in various parts of the forests, and 300 and more dead insects per square yard, sometimes covering the ground to a thickness of two inches or more, are no exception.

The larger of the two areas, in Rhineland-Pfalz, was soon completed and OV started his positioning flight of about 80 miles to the Eifel hills. Here, on the picturesque plateau dotted by vineyards and dark green needle forests, the operation was renewed. Nosey neighbours, big Sikorsky S-55s from nearby American airfields, came over to hover in the fields near our landing sites, or followed *Old Victor* on his spraying trips; and, as always, dozens and dozens of children lined the fences, gaping curious and open-mouthed.

The entire operation was completed within 14 days, of which two-and-a-half were non-operational because of the weather, and in just over 60 flying hours, including positioning. More than 300,000 litres of chemicals were sprayed, and we calculated that in these two areas alone more cockchafers were killed than there are people on the earth.

Then *Old Victor* carried on to his next call, in the picturesque Rhine valley not far from Rüdesheim, which is no unfamiliar name to lovers of Rhine wines. The Hesse State Vineyards were our next order, a meadow our landing site; the beautiful Eberbach Monastery was a landmark in the distance, and the very old, completely walled-in vineyard of about 70 acres of some of the best and most expensive wine in Germany was our hard and exacting task.

Not more than two days were needed for this work, on various small plots of a few acres each. Only very short positioning flights were necessary, but the very large delivery of insecticide required for certain kinds of vineyard work increased flying times considerably.

The Hesse pest-control authorities, among the most progressive in Western Germany, now approached us with an outstanding request, which we lost no time in meeting. With half a day to spare for cleaning and checking all equipment and positioning the inevitable "tail" of vehicles, we presented OV in the quiet town of Rhens, near Koblenz on the Rhine. Here, for the first time in Europe—and, we believe, the first time in the world—cherry orchards were to be sprayed by helicopter.

Various individual small owners in the total area of some 1,050 acres had joined together in a group under the auspices of the Government authorities; and all of them, with their wives and children, had assembled at a vantage point on one of the neighbouring hills to see their orchards sprayed. Single lines of trees in between vineyards and along the roads in the sleepy small town could not be left out, and it was a most impressive sight as OV swept down the hillside and on through the valley below us, the spray billowing out in huge swirls from the spray bars and extending far on either side. From Rhens, several of the small Rhine islands were sprayed—on these, only minute landing sites were at our disposal—and from there we moved to the next bigger areas along the Moselle river. In spite of

"The large-scale operational maps, duplicates of those held by the pilot, were checked constantly by the ground staff."

Concentration on communications

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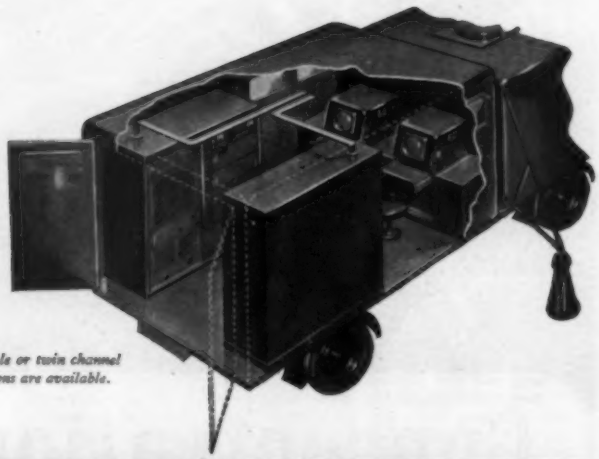

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Accessibility: The magnetron, like all major units, is readily accessible.

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"In vineyard work . . . the spray had to be so fine as to resemble molecules of fog, covering the leaves . . . on both sides."

AN AIR WAR IN GERMANY . . .

rain, the orchard-spraying was so successful that a projected further treatment in fourteen days' time was soon found to be unnecessary.

We were glad of this, for within the fortnight we were able to be away in Bavaria, busy on our largest contract yet—one which, being a completely new experience, presented not inconsiderable difficulties. The Government of the Free State of Bavaria had an area of almost 16,000 acres of pine woods threatened with destruction by the dreaded pine owl caterpillar, which would have meant a loss of some 500 million marks. The area was vast and monotonous, being mostly dense forest from boundary to boundary, with only an occasional clearing which might or might not be readily discernible from the air. Hop gardens bordering the woods presented a further difficulty, for we were to use diesel oil as a carrier base for the first time in our operations, so super-accurate spraying would be necessary in order to avoid contaminating the hops.

About 27 years ago, when the previous major operation against the disease was carried out in this area, it was done by pouring whole sacks of pure arsenic out of old-fashioned fixed-wing aircraft, contaminating fishponds, rivers, and grazing land. In the years that followed, several small-scale treatments of the area were made with ground equipment, using ordinary petrol—a most dangerous process. In all, the woods were in a deplorable state, the bare thin stems covered with creeping moss almost up to the small crowns.

Having flown over the area and seen little else but a vast expanse of dark green pines, no landmarks, nothing by which to orientate oneself, I thought the job looked pretty difficult. The operational maps were a maze of blue- and red-bordered areas. However, over 300 red and white marker balloons were ready to be filled from hydrogen bottles, to guide the pilot in his exacting task of laying swath beside swath of the perfectly clear but terribly smelly chemical and oil mixture. Unlike the cockchafer, pine owl larvæ breed in the centre of the forests rather than on the edges, so the entire area had to be covered most carefully. If only 4 per cent of the caterpillars escaped the entire operational success was questionable.

As it happened, success was jeopardized by a succession of unexpected circumstances. To sum them up briefly, we first had a complete failure of the spraying equipment, because none of us had realized that the oil could cause swelling of the rubber washers in the nozzles; then, when the operation nevertheless began at the appointed time, and all was going well, the pilot was startled to find the marker balloons descending one after another—the oil was again the culprit, causing minute holes in the thin rubber envelopes; and, thirdly, the weather was against us—we could not spray onto wet trees, and often had long enforced rest periods in the middle of the day.

But the difficulties were overcome, the first by a series of hectic telephone calls which eventually produced a set of plastic nozzles and the second by an appeal to Radio Free Europe in Munich, who willingly supplied us with a number of the plastic balloons with which they ferry publicity material over the iron curtain (the pilot, accompanied by the writer, had a long and tiring flight to the isolated station on the Czech border to collect the balloons).

About the weather we could of course do nothing, but we made fair progress, and at last the reports began to come in. They were good. In one area done, where about 40 trees were felled for a thorough check, only two caterpillars were found alive out of an estimated total of 3,000.

From landing site to landing site we worked our way through day after day of hard work, until, after 13 days of operation and about 80 flying hours, with pauses because of bad weather, we had completed the entire colossal area.

And so *Old Victor* brought the pest control season in Germany to a close, having successfully completed the strenuous demands made of him. He had flown over 140 hours in less than six weeks, immediately following a 2,000 hr check at Croydon under the watchful eye of veteran helicopter chief engineer Bill Shippey. No technical snags were experienced, OV flying faultlessly in the skilful hands of chief pilot Linc Lord and Stan Holdaway (who was, incidentally, flying these contracts within fourteen days of his return from an Antarctic expedition).

Many letters of appreciation and recommendation were received from the German ministries for whom the contracts were carried out. The air ministries of the various "Lands" concerned were at all times most helpful. They allowed our pilots absolute discretion in the selection of landing sites (an action hitherto unheard of in Germany) instructed airports to grant every assistance, and allowed positioning flights in weather bordering on I.F.R. conditions.

And as these words are written, *Old Victor,* as becomes a faithful warrior, rests inside a Silver City Freighter to return from Germany to Croydon, for preparation by Autair, Ltd., for his next big assignment—the Antarctic Expedition 1956-7. Next spring should see him back again, and fitted with spray gear he will be engaged in Germany on his destructive pursuit of cockchafers and caterpillars. How we look forward to his proud and gallant return . . .

"The chemicals (D.D.T. compound and water) were mixed . . . and the helicopter's tank filled in eighty seconds."

The inhospitable country of the Dauphine Alps, near Crest, photographed by Frank Foster from the T.42. On the day of the flight described here, the mountain-tops were in cloud. The sailplane is the Skylark 3 flown by the Dutch pilot Toutenhoofd.

RIDING the MISTRAL

A Memorable Alpine Sailplane Flight in Unco-operative Weather

By PHILIP WILLS

BRIEFING TIME, the World Gliding Championships at St. Yan aerodrome in central France, July 11, 1956 . . .

"The task today," announced M. Eyraud from the platform, "is a goal race from St. Yan to St. Auban on the River Durance, a distance of 302 km. The aerodrome on your maps is called Château-Arnoux. In view of the distance of this flight and the mountainous nature of the route the retrieving trailers must follow, there will be no contest tomorrow."

There was a rustle of excitement amongst his 200-odd hearers, as M. Gerbier, the meteorologist, took his place on the platform and pinned up his cabalistic charts. He turned at last to his expectant audience and said: "Nous avons aujourd'hui la situation classique du Mistral." It was enough. We were given today the longest, most spectacular, and possibly the most exciting goal race that had ever been offered a championship meeting.

* * *

THE MISTRAL is a strange, strong northerly wind that roars its way from Lyons for 160 miles down the regal valley of the Rhône to the Mediterranean. On either side the valley is flanked by mountain chains, with the result that any north-westerly wind arriving at Lyons is funnelled and concentrated into the deep groove of the valley and becomes a fast steady northerly stream, hot and dry in summer, cold and dry in winter. This rapid corridor of air is also descending so that in summer it is quite cloudless, thus from a very great height the eye would see a river of cloudless hot air, 30 miles wide and 160 miles long, cutting a straight line between vast areas of sky dotted with cumulus and wave clouds on either side.

From the sailplane pilot's point of view, this corridor presented a serious problem, since there would be little lift to be found in it, yet we had to cross it to reach our goal. Clearly the best plan would be to try and get round the northern end of it, over Lyons itself, and then dash south-east to the virile mountain air of Drôme, the Basses Alpes and Provence. From here on the prospects were exciting enough, since these mountains, roughly speaking, form a series of parallel spines running from west to east, forming the outlying spurs of the Hautes Alpes dominated by Mont Blanc. These escarpments thus face directly into the northerly Mistral and deflect it powerfully upwards, so that any sailplane reaching them must find very strong lift on each windward face, and strong wave formations over the whole area reaching heights certainly in excess of 20,000ft.

The dish we were therefore offered was a royal *Macédoine de Fruits*, containing almost all the major forms of up-currents used by sailplane pilots: on the leg to Lyons thermal and cloud-flying, thereafter slope-soaring on a gigantic scale and wave-flying. Never have sixty pilots strapped themselves into their brightly-coloured cockleshells with livelier anticipation.

The 60-mile flight as far as Lyons over the Monts du Beaujolais was a little more difficult than we had expected, but most of us survived it. At the base of many of the cumulus into which I circled I found large flocks of darting swallows, feeding on the swarms of insects carried up in the warm rising air from the sunny fields below; but the birds never followed the insects or me into cloud, being just as incapable as I would be to fly blind were it not for the additional powers conferred on me by the magic properties of the gyroscope. After Lyons, forty more miles on a south-south-easterly course and I would reach the mountains, and all, I thought, would be well.

It was a strugggle, but I made it, and the wide bowl of Valence opened up, of which the south-eastern part is boxed in by two walls of mountain at right-angles to each other, rising almost sheer to over 3,000ft. But something had gone wrong; the situation was far from classic after all. The meteorologists must have made some minute error in their forecast of the moisture-content of the air, for instead of ranges of mountains rising sharp and hot into clear air, with puffs of white cloud far overhead, the view ahead on course consisted of sinister black walls rising up and disappearing into a complete sheet of grey and black cloud.

To offer oneself up to one of these frowning cliffs and be sucked up into, and possibly above, such a pervading and turbulent shroud would obviously be suicidal, since one would either (a) fly blindly into one of the myriad peaks or, (b) get trapped over the clouds, with no possibility of navigation and the eventual certainty of finally having to descend again, quite lost, over virtually unlandable country.

Our course lay south-east diagonally over the mountains; but, since this was clearly impossible, the only alternative was to try to keep to the westerly end of each ridge, within reach of the Rhône valley and, whilst keeping under cloud, climb high enough on each face to enable one to dart over it or round it on to the one behind it. But this was not to be easy.

The lower half of each escarpment was densely clothed in trees, the upper part bare and jagged rocks, and there was no hope of landing at the foot, whilst the wind was so strong that once pinned to the face it was impossible to force one's machine any distance north again to reach kinder country. And each succeeding mountain-wall was partly "in irons" from the one in front of it, so that if one reached it more than half way down there would probably be no lift at all, but a wildly turbulent cataract of air which would sweep one helplessly down to the rocky floor of the cleft below.

However, this was World Championship flying, not a Sunday afternoon at Dunstable, so after a lot of delicate juggling I got myself pinned against the first battlement, and was rapidly swept up, a span or two away from the precipice, to the top. Towards the east the razor-edged ridge ran up into the cloud-sheet, but where I was there was perhaps a 300-ft gap through which I could peer downwind, over the precipitous valley of the Drôme

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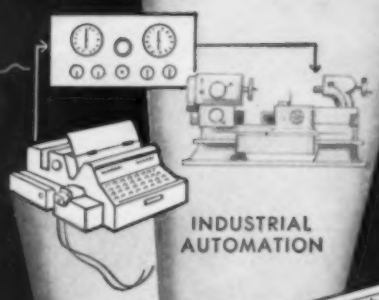

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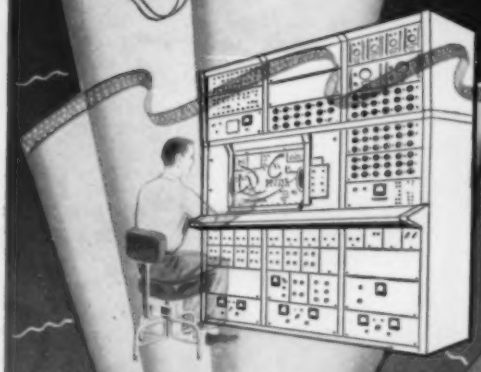

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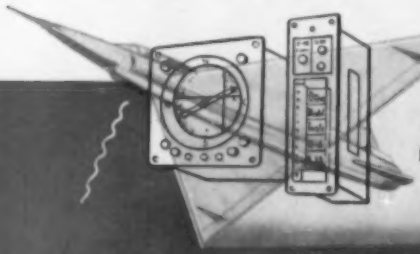

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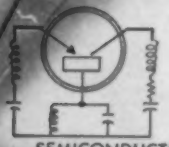

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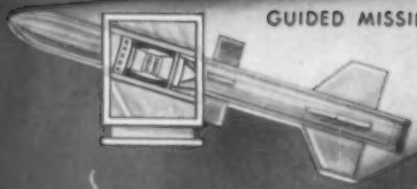

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RIDING THE MISTRAL . . .

to the next range of Roche Courbe, a 5,000-ft mountain towering up invisible and menacing into the ceiling of cloud. And now I saw something which put the lid on my troubles, and made me realize that my catalogue of woes had so far been incomplete. Over the valley of the Drôme, looming and rotating like a gigantic garden-roller, was the largest rotor-cloud I have ever seen.

* * *

Most people still think that the most extraordinary and dangerous conditions tackled by sailplane pilots are in cumulo-nimbus or storm-clouds, and certainly to wrestle one's way up through the rain and hail and lightning of one of these monsters to heights in excess of 30,000ft is exciting enough. But such great strides in instruments and in design have been made since the war that large numbers of flights in these clouds have been made in the last ten years without dangerous results. In fact, we had had a very good example at St. Yan a few days before this flight, when 27 sailplanes went into one such cloud, reaching heights of up to 25,000ft without any trouble arising.

But within the last few years explorers of wave-systems in the lee of mountain ranges have come across layers of incredibly turbulent air, frequently marked by vast untidy rollers of cloud called rotor-clouds. These rotors can be seen by the naked eye to be rolling over and over at high speed, with rags of tortured cloud being flung over and out at all levels, and in and underneath them the air is tossed around with unprecedented violence. Last year in such a cloud in the U.S. an exploring sailplane quite suddenly literally disintegrated, in spite of strength factors higher than those of many aeroplanes, and the pilot had a miraculous escape by parachute. He found himself falling with the nose of the glider locked to his feet by the straps of his boots; but when he pulled his rip-cord the jerk was sufficient to pull his feet out of his laced boots, and he descended to safety.

Now I knew that the formidable monster I could see was not likely to be such a killer, since the mountains over which I was flying were far smaller than those of the Californian Sierras; but in this case I was faced with the problem of flying under it whilst surrounded on nearly all sides by invisible mountain peaks, at an altitude insufficient to give me much chance of finding a safe landing place should I be forced down. I heard myself saying, "And we do this for fun!" I decided to try out a trick I had practised earlier in the year on the smooth and friendly slopes of the Long Mynd. The plan was possible because of a miraculous little compass recently invented by a gliding enthusiast at home which is "dead-beat" and shows one's course instantaneously at all times. Keeping to the west end of my escarpment, where there was a small gap of clear air between the crest and the cloud, I checked my compass course on each tack of my beat and allowed myself to be drawn up blind into the cloud.

Six minutes on 050°, turn, four minutes on 335°, turn, six minutes . . . all the time watching my rate-of-climb indicator like a fascinated rabbit. Green, up 5; green, up 3; green, up 3—rapidly and easily we gained a further 1,000ft then, blind, turned and held a grim southerly course. The climb turned to a descent, two or three minutes went by, and we broke cloud, over the Drôme valley, safely south of the mountain I had just left.

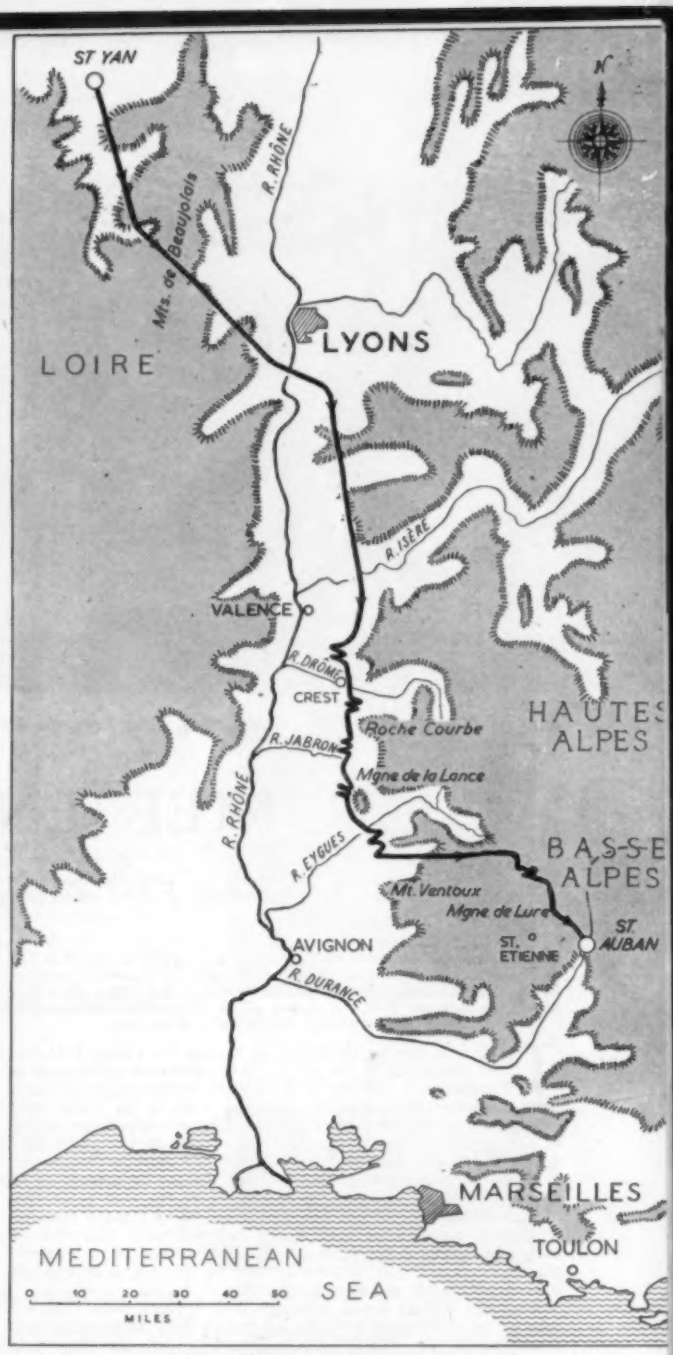
Suddenly there was a jar and a shock, and my starboard wing fell into nothing. With full opposite aileron we hung and slid in space for what seemed an age. The next ten minutes were unforgettable. Seven pilots eventually completed this flight, and all confessed they had never experienced such wild turbulence before. Many were forced to land in the Drôme valley, and Bill Ivans, the American holder of the world altitude record in the Bishop Wave in California, had his machine fall out of his hands at sixty feet into a rocky field—it was completely destroyed, and Bill cracked a vertebra and was laid up in hospital in plaster.

But my extra 1,000ft stood me in good stead, and a shaken pilot reached the Roche Courbe ridge in one piece, climbed, dodged round behind it over the Jabron to the Montagne de la Lance, and again over and to the valley of Eygues.

Here patches of blue sky began to show between the mountains, and it became possible to try and mount through the rough air, up past the clouds to the wide smooth waves in the blinding blue air above. Since these waves would run due east, once attained any one of them would lead one in blissful smooth silence straight over the mountains to the goal in the valley of the Durance to the east.

And this is what happened. With the vulturine bald-headed Mont Ventoux to the south marking my position exactly, I struggled and slowly gained height in the wild air, until quite suddenly I was over it, riding in silky silence whilst below me the clouds lay in enormous ribbon-like rolling masses from west to east like the warp-threads of an enormous loom.

I climbed to 10,000ft and set course direct for the goal. The contrast between the struggle and the maelstrom I had left and this last leg of the flight was almost too dramatic to be real. It



Map illustrating the flight from St. Yan to St. Auban. The shaded area is bounded by the 3,000ft contour.

was nearly seven o'clock, and the sun was setting beyond the Rhône valley to the west. To the south the clouds dissipated and the brown and grey parallel spines of Provence, like ranks of soldiers, led the eye on to a distant blue circle which was the Etang de Berre behind Marseilles. To the north-east, cloud-piercing snow-capped mountains swelled up to Mt. Pelvoux and the *massif* dominated by Mt. Blanc. Below and to the north-west was my carpet of rolling cloud, dazzling white and glowing pink in the sinking sun. In absolute calm, in absolute peace, with a whisper of silken air over the wings, I flew at 10,000ft and nearly 100 m.p.h. to the goal which had seemed so impossible to reach.

The valley and the blue Durance opened up ahead, I jumped back two waves to the Montagne de Lure, and there was the aerodrome, on the river bank. I put my gallant Skylark into a steep dive and crossed the line at nearly 100 m.p.h.

As I landed and got out, the hot gale struck me in the face. The Mistral. "*Une situation classique du Mistral.*" As I said afterwards to M. Gerbier, he must have been thinking of the more sombre classics, such as Dante's Inferno?

A recent "Flight" photograph of Gordon Slade, Peter Twiss, the Fairey team resident at Boscombe Down and the record-breaking F.D.2.

BRIEF ENCOUNTER

Fairey F.D.2 Participation at Farnborough

WE consider the demonstration programme arranged for the F.D.2 at this week's S.B.A.C. Flying Display to be worthy of special mention. By the time this issue appears the Display should have taken place four times; whether the F.D.2 is shown off in the manner described is, however, dependent on the state of the sky.

THERE is much justification in hailing the Fairey F.D.2 as "the aeroplane of the year." In its previous appearance at Farnborough, the full potentialities of this rakish research delta have not been exploited, but, in view of its world-wide renown as the vehicle with which the present world speed record (1,132 m.p.h.) was gained, the Fairey Aviation Company have ensured this year that the flying of the F.D.2 shall be memorable.

A demonstration has been arranged intended to impress on all spectators the extreme performance of which the next generation of fighter aircraft will be capable, and at the same time to emphasize the rapidity with which such machines can close on each other. The flight programme should also serve to illustrate the excellence of the manœuvrability of the F.D.2 at extreme supersonic speeds and at high altitude.

Both the F.D.2s (serial numbers WG 774 and WG 777) will take off approximately ten minutes before their demonstration is scheduled to take place; in fact, they will leave the runway in company with the Supermarine N.113. One machine will turn to the south-east upon leaving Farnborough and will climb to contrail height (about 35,000-40,000ft) over Gatwick Airport. The second aircraft will maintain a north-easterly heading and will also climb steadily to reach contrail height over Newbury, Berks. By this time the two Deltas will be roughly 53 miles apart, with Farnborough equidistant between them. Plotted by radar, and under ground control, they will then turn towards each other and fly straight and level so that they will pass each other directly over the centre of Farnborough airfield with a safe lateral and vertical separation.

The afterburning Rolls-Royce Avon of each aircraft will be opened up at the start of its run, and the bringing in of reheat will be rendered obvious by a marked intensification of the contrail. If the sky is clear, the contrail from each machine should be readily visible when the aircraft are each 18 miles from Farnborough. At this time the two Deltas will be closing on each other at a relative speed of about 1,670 m.p.h. (Mach 2.5). They will continue to accelerate up to a final closing velocity appreciably in excess of 2,000 m.p.h.; in fact, the figure may be as high as 2,400 m.p.h. It is now known that the F.D.2—a thick-skinned machine with a strong structure and irreversible control surfaces—is quite able to pass through the intense shock pattern of its sister ship without suffering damage or loss of control. The familiar bangs will arrive at the airfield almost simultaneously some 25 seconds after the aircraft have crossed overhead. Incidentally, bangs from level-sonic aircraft have not previously been publicly demonstrated in this country.

After passing over the airfield, the Delta travelling to the south-east will turn to port through 270 deg while maintaining its altitude and contrail. The other machine will also turn to port, but through only 90 deg, and will decelerate rapidly to subsonic speed with power off and speed brakes opened. In this condition, it will let down rapidly to circuit height. Then, with power on again, it will make a fast run across the airfield from the south-west —the well-known "Laffan's Plain end"—and will perform two rapid rolls, a 180-deg turn and a run in the opposite direction, demonstrating rolling performance and deceleration with speed brakes open. The second aircraft will then also descend, make one pass and join the circuit for landing.

The pilots will, of course, be the company's chief test pilot, G/C. Gordon Slade, and his famous second-in-command, record-holder, Peter Twiss. Both are in the heading photograph.

Obviously, if the F.D.2 flying goes according to plan, it will be one of the most impressive sights to which Farnborough audiences have been treated to date. On the other hand, its success depends to a large extent on there being plenty of blue sky and a reasonable contrail height. The latter is particularly important since, for the aircraft themselves to be clearly visible, the flying would have had to be at less than 15,000ft, and evidence shows that supersonic runs at this altitude would cause "considerable disturbance."

FOR FAULTLESS TV

ANY television user bothered by distortions or other faults on his screen, and not knowing how to rectify them, should find the answer to his troubles in a useful booklet called *Correcting Television Picture Faults*. Written by Mr. Leonard Stanley and illustrated with over 150 "tele-snaps" taken by Mr. John Cura, it describes and explains—both in layman's and in technical language—every possible reception fault and how to rectify it. The book, which should also prove valuable to TV engineers and dealers, is published for *Wireless World* by Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1, at 3s 6d net (postage 3d).

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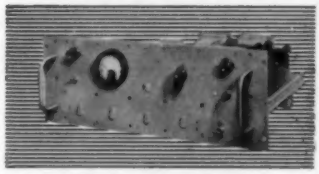
The corner of an Air Traffic Controller's desk showing the neat grouping of VHF channel controls.

Top right is the 50-watt Type AD801 Transmitter housed in a cabinet with its associated Modulator and Power Supply.



The Type AD818 Crystal controlled Receiver shown in the bottom illustration is used in conjunction with both the 801 and 811 Transmitters.

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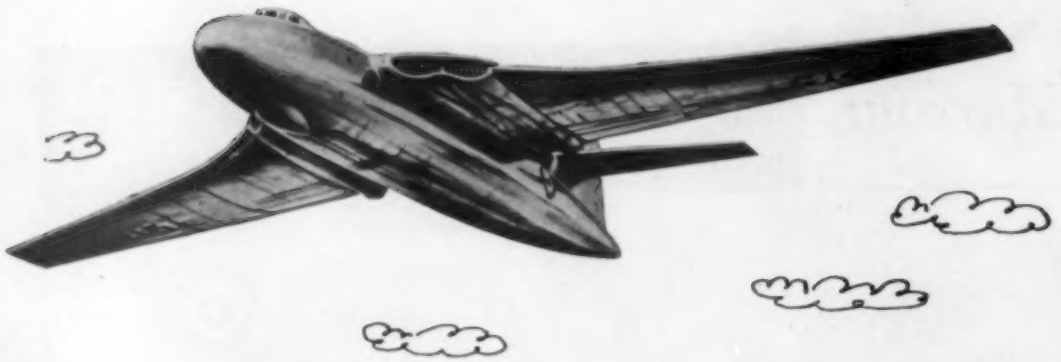
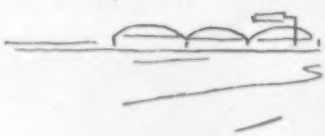


In the air . . .

on the ground . .



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TA9793

We referred on August 10 to the opening of the new airport at Kuala Lumpur. Claims that it is one of the most modern in Asia are borne out by this picture of the fine terminal building. B.O.A.C. are now using "K.L."

CIVIL AVIATION

B.O.A.C.'s ANNUAL REPORT

JUST before Sir Miles Thomas retired from the chairmanship of B.O.A.C. on April 30, he said that a net profit of some £500,000 (nearly double the previous year's surplus) had been made up to the end of the financial year ending March 31, 1956 (see *Flight*, April 20). It was thus felt that the Corporation was steadily winning back the ground which it lost through the withdrawal of Comet 1s, but these hopes were abruptly dispelled only a month later when the new chairman, Mr. Gerard d'Erlanger, forecast a £1½m loss for the current year—i.e., ending March 31, 1957.

It now appears from B.O.A.C.'s annual report for 1955/56, published on September 1, that Sir Miles' estimate of £500,000 as the net profit for the year was somewhat over-optimistic: the actual net surplus remaining after payment of capital charges, etc., was £117,731—less than half the equivalent figure for 1954/55 (£261,687). Total profit before payment of capital charges was £1,295,525 (the equivalent figure for the previous year was £1,362,180). For the first time in its history, however, the Corporation ended the year with a small accumulated surplus, amounting to £17,881.

The reason for the Corporation's decline is, of course, simply its lack of suitable equipment, and this forms the theme of the annual report; it is, however, to B.O.A.C.'s credit that the number of passengers carried increased by 32 per cent above the previous year. The overall load factor declined from 63.7 per cent to 61.7 per cent, and of course it will be difficult to win back higher load factors until the Britannias, DC-7Cs and Comet 4s are in regular service. In the conclusion to the report, Mr. d'Erlanger observes that an important factor contributing to the anticipated heavy deficit this year is the expenditure incurred in introducing these new types into service—two of them, the Britannia and the DC-7C, in one year—without any appreciable attendant revenue. The Britannia should, of course, if introduced into service as hoped on October 1, have six months in which to earn revenue, although the DC-7Cs are not due in service on the North Atlantic until January.

Mr. d'Erlanger also points out that the expense of introducing a new type is increased when, as with the Britannia, the engines also are not developed and start operational life with a low overhaul period. The chairman refers to the adverse effect on the Corporation's economics of the fact that no fewer than five different types will soon be operated—Britannia, Stratocruiser, DC-7C, Argonaut, and Constellation. He makes brief reference only to the purchase of new equipment: "It is essential . . . that the Corporation should be equipped with the right aircraft for its needs . . . the Board [has] made certain recommendations to the Minister of Transport and Civil Aviation about their North Atlantic requirements."

A significant fact emerging from the report is that, in keeping with the general trend, the Corporation is now selling more tourist seats than it is first-class seats: the ratio is 53 per cent to 47 per cent, and undoubtedly the tourist market will widen further when B.O.A.C. in company with other operators reduces fares on the North Atlantic in April 1958. Because of the predominance of tourist traffic, total passenger revenue rose only 20 per cent, despite the fact that 32 per cent more seats were sold. Encouragingly, the cost of producing each capacity ton-mile (260m c.t.m.s were offered) fell slightly from 39.9 pence to 38.0 pence.

A recent picture of B.O.A.C.'s first Britannia 312, due on the Atlantic route "late in 1957."

CAPITAL'S AVONS

IN discussing the Capital Airlines order for Comets in our August 3 issue, we quoted a statement reported to have been made by Mr. R. M. Kendall, general manager of Rolls-Royce Canada, to the effect that Capital's Avon engines would, like their Darts, be overhauled in Montreal. Mr. Kendall has since pointed out that in fact Capital have overhauled their Dart engines from the inception of Viscount operations, and that they plan to do the Avons also themselves.

Rolls-Royce Canada's assistance to U.S. operators will follow the T.C.A. pattern, whereby technical assistance, service engineering, spare parts and so forth are provided from Montreal. The same procedure will apply also to Continental Air Lines and to the various operators of the Fairchild-built Friendship.

CZECHOSLOVAKIAN COME-BACK

PRAGUE radio last week broadcast an interview with Josef Prochazka, director-general of Czechoslovak Air Lines, who stated that Czech aircraft are at present flying to Moscow, Warsaw, Budapest, Paris, Berlin, Copenhagen, Stockholm, Helsinki, and a number of other capitals. (A recent report from Belgium said that Czech services to Brussels—discontinued in 1951—were due to be resumed on October 3.) Ten foreign air transport companies, Mr. Prochazka said, were now running services to Prague, including Aeroflot, Malev (Hungary), Tabso (Bulgaria), Tarom (Rumania), K.L.M., Sabena, Air-India, and Air France. New runways, he said, would be built at Prague before the end of the year, so that the Czech capital would have an airport "corresponding to the world's best." With regard to the equipment of Czechoslovak Air Lines, Mr. Prochazka said it was intended gradually to convert to jet aircraft. "New aircraft" would be put into service in the next five months on existing services.

CIVIL AVIATION . . .

The re-opening on August 25—after 17 years—of Lufthansa's South American route with a twice-weekly Super-G Constellation service between Hamburg and Buenos Aires was an occasion for mutual congratulations between West German Transport Minister, Herr H. C. Seebohm (left), Captain Meyr, and Lufthansa director, Herr H. Weigelt (right). The airline is to start services to Istanbul, Beirut, Baghdad and Teheran on September 12.

YORK ACCIDENT REPORT

THE recently published findings of the investigation into the accident to York G-AMUL at Stansted Airport on April 30, in which an aircraftman and a four-year-old girl were killed, attributes the accident to "a grave error of judgement and skill by the pilot."

After the York had been lined up on the runway in use—a temporary, "though by no means makeshift affair" composed of a former taxiway 5,700ft long with the addition of two shoulder strips on either side—it started to run slightly to port off the runway centre-line. "I corrected the take-off run," said the pilot, Captain Wilson, in giving evidence, "and the aircraft seemed to come straight. Then I felt a violent swing to the right . . . I pulled everything [the throttle levers] off and continued on. . . After I got my hands off the throttles I was preparing to use control of the brakes to pull the aircraft up. The aircraft seemed to roll off. The next thing we were off in a 180 deg turn. Then of course we sat down." Supplementing his captain's evidence, First Officer Upperton described how he noticed that they were on the left-hand side of the runway. "The captain pulled the throttles back and put his right hand on the control column," he added. "Almost immediately I pulled back No. 1 throttle—the port outer—because it was not fully closed."

The findings state that after the aircraft had left the runway (still swinging to starboard and with its wheels skidding to port) it encountered a "French drain"—a trench filled with stones and pieces of concrete—and the undercarriage collapsed.

Although the captain was convinced that he did not touch his brakes during the initial correction, the Court was of the opinion that the tyre marks—the starboard wheel first—"could only result from a correction of the portward course due either to a sudden and excessive differential use of the throttles or to a momentary application of brake to the starboard wheel or to both these factors. It is difficult to attempt to judge whether his decision to close the throttles and to abandon the take-off was the right decision . . . nor easy to criticize what he did or failed to do after he had closed the throttles . . . I am not prepared to condemn Captain Wilson's decision to close the throttles or his subsequent failure to control the course of the aircraft. The vital error was committed earlier when he started to correct his portward course."

BRITANNIA'S HOMECOMING

BRITANNIA G-ANBJ was due to arrive back at London Airport last Friday after its tour of the United States and Canada. Since its arrival in New York on August 13, representatives of Eastern, National, Northeast, Pan American, Continental, Frontier, Trans-Ocean, United, American Airlines and the Aerovias Guest airline of Mexico have flown in the aircraft.

The "grand tour" has been made in two stages. The first took G-ANBJ from New York across the continent to San Diego and Los Angeles, whence it returned to New York in "medium-haul" hops, one of which took it to Vancouver. The second stage began the next day with a four-hour flight to Miami, where, in addition to the demonstration flights given to airline officials, a flight over Nassau was made at the request of the Governor of the Bahamas.

From Miami, the Britannia turned north to Washington, where it landed at 0455 G.M.T. on Sunday after a flight time of 3 hr 18 min. The next stop was Ottawa, reached on Tuesday, August 28, after a flight lasting 2 hr 8 min, where two demonstrations were given to representatives of Canadair, T.C.A. and the R.C.A.F. Final stages of the tour were a half-hour trip to Montreal and a final visit to New York. The Britannia was due on August 30 to leave there on what was hoped would be a non-stop flight to London Airport; and by the time these words appear, G-ANBJ should be showing itself off at Farnborough.

Meanwhile, the B.O.A.C. Britannia which was due to leave on a proving flight from London Airport to Johannesburg on August 28 was delayed for 24 hours by an engine snag. The hold-up had no connection with the engine-icing modifications.

THE TASK AND THE FORCE

THE Third I.C.A.O. Air Navigation Conference, to be held in Montreal between September 18 and the latter part of October, will undoubtedly be the most hard-worked yet. It will be recalled that one important outcome of the I.C.A.O. Assembly at Caracas was the proposal to form a so-called task force to study and recommend improvements to the world's air navigation facilities, and the Montreal conference may well see the first meeting of this committee. It was proposed at its formation in June that the target date for completion of studies should be the "end-of-1957." There would appear to be little time to lose.

From I.F.A.L.P.A., collecting-house of world airline pilot-opinion (one or two representatives will join the task force), will come proposals ranging from recommendations regarding reverse thrust, emergency exits and rearward facing seats to thoughts about operational control—particularly with reference to the relationship between the pilot and flight operations officer, or "flight despatcher."

More familiar ground (a paragraph appeared on page 131 of *Flight*, July 20), is the Federation's working paper upon the proposal that the system of licensing aircraft engineers might be vested in "approved" airlines or organizations. I.F.A.L.P.A.'s paper now includes the pilots' alternatives to this proposal, which, while recognizing that the present licensing system is outmoded, suggests that a workable basis for a new scheme might be found in their own licensing system, which, it says, "would not be so restrictive that all unqualified engineers were excluded nor so lax that all recognized professional standards were absent."

Of other I.F.A.L.P.A. recommendations, a paper on reverse thrust raises objections to the inclusion of this device in requirements for landing run or accelerate-stop distance. "The reverse-thrust device as an added aid to landing," says the Federation, "does no more than compensate for other adverse factors which may be present during a landing and which, like reverse thrust, are at present unaccounted for." The voice of the pilots at international conferences concerned with air safety has—as it should—become most clear and insistent.

BREVITIES

A CHANGE in B.O.A.C.'s Britannia order is being considered whereby the Corporation might take delivery of an additional seven Britannia 312s in place of the seven 302/305s now on order. This suggests that these seven aircraft, which are well advanced, could be released to new customers at an early date. It is significant that president of Northeast Airlines, Mr. George Gardner, was due to fly to England in the home-coming Britannia (see above) for talks at Bristol.

* * *

Eagle claim to have provided the largest number of flights during the recent airlift of troops to the Mediterranean: 21 Viking flights were made between August 14 and August 17. The company's normal services have been maintained.

Gibbs Sepik Airways of New Guinea have purchased three Junkers Ju 52s and are fitting them with ex-Wirraway Wasps of 600 h.p.; this, they say, increases speed by 25 m.p.h.

* * *

A contract for the supply of I.L.S. equipment for installation at Geneva Airport has been secured by Pye, Ltd.

* * *

The first DC-8 is scheduled to fly in March 1958. The first nine DC-8s will be used for flight-testing and certification, and 12 will be delivered to the airlines prior to certification.

* * *

Electronics in the DC-8 will weigh 1,200 lb, plus 1,200 lb for

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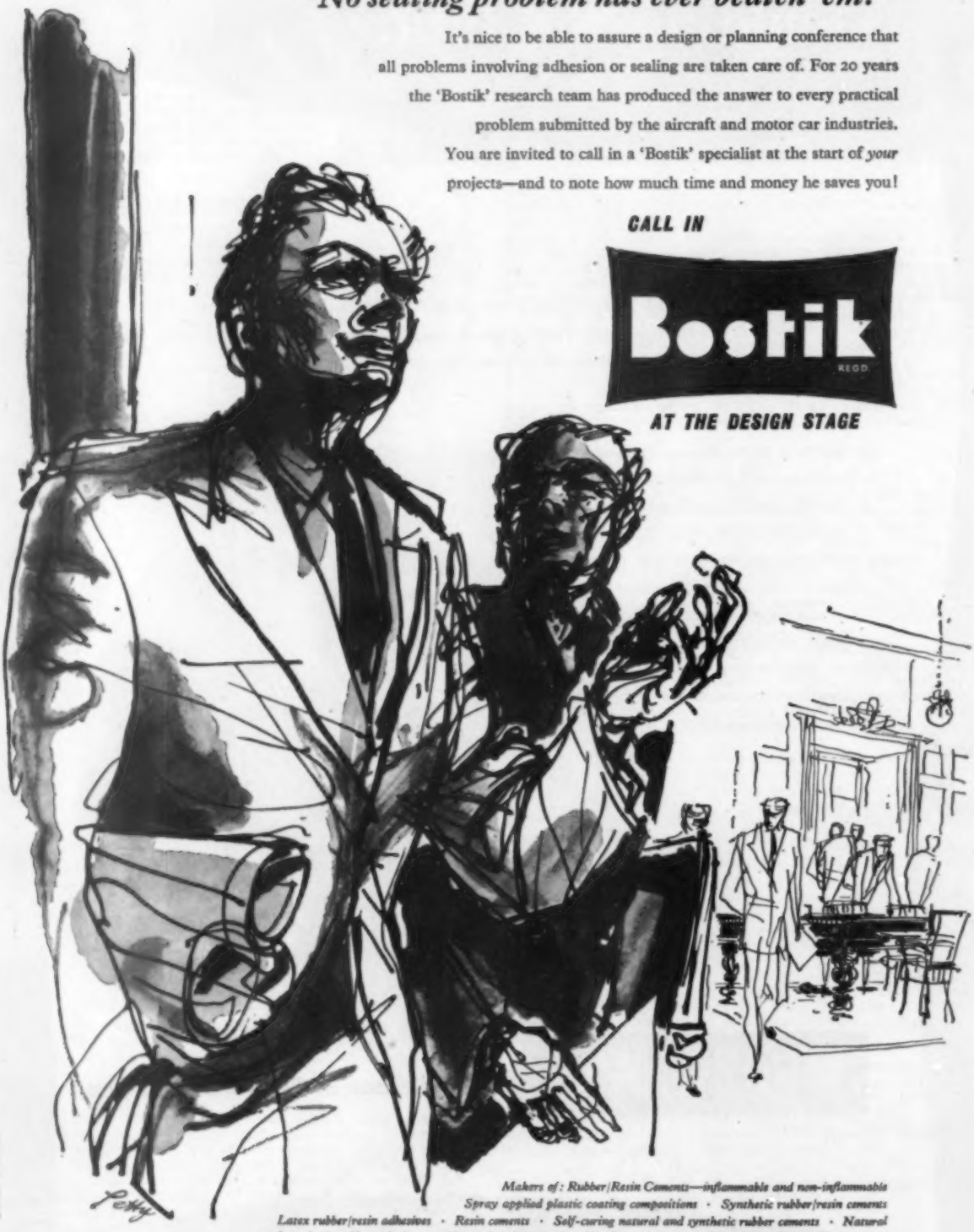

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CIVIL AVIATION . . .

installation and wiring. The DC-8 will have 20 aerials, of which three will be external and two semi-flush.

* * *

The A.R.B. announces the issue of Notice 16, Issue 4 (dated August 17) to licensed aircraft engineers and to civil owners. It points out that Government surplus material may have become unserviceable after becoming redundant.

* * *

Mr. Lloyd Wilson has been appointed PanAm's Atlantic division traffic manager.

* * *

Trek Airways state that they have just acquired two Hermes (the last of B.O.A.C.'s fleet of this type) to add to their three Vikings.

* * *

It is reported from India that the Government has approved Air-India's decision to order three Boeing 707s (see *Flight*, July 20). It is anticipated that deliveries would be made early in 1960.

Air France hope to introduce L.1649As next June.

* * *

Mr. John Norton has been appointed B.E.A.'s North American sales manager as from January 1 next.

* * *

Unless traffic between Greatham (West Hartlepool) and London improves, B.K.S. will, they state, have to withdraw their service at the end of September. The company's other services from Greatham will continue.

* * *

The C.A.A.'s $250m programme to improve U.S. traffic control, recently telescoped from five to three years, is now under way. Nearly 200 sites have been selected for the installation of new equipment.

* * *

Viscounts will come into regular use on B.E.A.'s service to Jersey in the summer of 1958. DC-3 Pionairs, which are today the most frequently used B.E.A. type on the London-Jersey route, are, according to the Corporation's chief executive, Mr. Anthony Milward, to be entirely replaced during the next five years.

THE AIRLINES' SHOPPING LIST

THE measure of transport capacity in the 1960s, and its relationship to the expected heavy growth in the number of passengers demanding seats, is of the greatest concern to operators and manufacturers alike. The conclusions drawn from the overall picture vary from despondent accusations of excess buying to predictions that poor service will result unless more equipment is ordered (see *Flight* for August 24, page 279).

The steady pace at which the order-book for new transports is growing may be seen by comparing the table below with that presented in *Flight* of January 13. The dates given in brackets, where these are available, refer to first deliveries, and military orders for Metropolitans and Britannias have again been included.

ORDER BOOK

Correct to August 31, 1956, and excluding options.

Aircraft	Variant	Powerplant	Airlines (listed in order of purchasing)	Total
Douglas DC-8	Overseas or Long-Range Domestic	Pratt and Whitney JT4	PanAm,* 21 (Dec. 1959); United, 15 (May 1959); K.L.M., 8 (March 1960); Eastern, 18 (May 1959); J.A.L., 4 (1960); S.A.S., 7 (1960); Panagra, 4 (early 1960); Swissair, 2 (first half 1960)	110
		Rolls-Royce Conway	T.C.A., 4 (early 1960)	
	Domestic	Pratt and Whitney JT3	United, 15 (May 1959); National, 6 (Midsummer 1959); Delta, 6 (June 1959)	
Boeing 707	120	Pratt and Whitney JT3	PanAm, 6 (Dec. 1958); American, 30 (operation on June 15, 1959); Continental, 4 (May 1959); T.W.A., 9 (April 1959)	107
	220	Pratt and Whitney JT4	Braniff, 5 (Oct. 1959); Sabena, 4 (Dec. 1959)	
	320	Pratt and Whitney JT4	PanAm, 17 (March 1959); T.W.A., 18 (April 1959); Air France, 10 (Nov. 1959)	
	420	Rolls-Royce Conway	Lufthansa, 4 (summer 1960)	
Bristol Britannia	102	Proteus 705	B.O.A.C., 15 (current delivery)	55
	250	Proteus 755	R.A.F. Transport Command, 10; M. of S., 3	
	300-series	Proteus 755	M. of S., 1; B.O.A.C., 7 †	
	310-series	Proteus 755	B.O.A.C., 11; El Al, 3; C.P.A.L., 5	
Douglas DC-7C Seven Seas	—	Wright R-3350	PanAm, 27 (current delivery); Swissair, 4 (current); S.A.S., 14 (current); Sabena, 9 (late 1956); Braniff, 7 (summer 1956); B.O.A.C., 10 (October 1956); K.L.M., 10 (1957); Northwest, 8; R.E.A.L., 3; Panair do Brasil, 4; Alitalia, 4; C.M.A., 4; J.A.L., 4	111
Lockheed L.1649A Super Star Constellation	—	Wright R-3350	T.W.A., 24; Air France, 12; L.A.I., 4; Lufthansa, 4; Varig, 2 (Dec. 1957)	46
Convair 440 Metropolitan	—	Pratt and Whitney R-2800	R.E.A.L., 4; S.A.S., 16 (March 1956); Finnair, 2 (Feb. 1956 and Feb. 1957); Sabena, 12; Swissair, 11 (June 1956); Iberia, 5; Continental, 3 (Feb. 1956); National, 6; Delta, 8 (Jan. 1957); Eastern, 15 (May 1957); Braniff, 5; Alitalia, 2; Yugoslav Airlines, 1; Lufthansa, 2 (March 1957); Air Carrier Service, 2; R.A.A.F., 2; U.S.A.F., 6; Corporate customers, 9	111
Sud-Est Caravelle		Rolls-Royce Avon RA.29	Air France, 12 (1958)	12
de Havilland Comet	4	Rolls-Royce Avon RA.29	B.O.A.C., 19 (mid-1958); Capital, 4 (Nov. 1958)	33
	4A	Rolls-Royce Avon RA.29	Capital, 10 (June 1959)	
Lockheed Electra		Allison 501	American, 35 (Aug. 1958); Eastern, 40 (Aug. 1958); Braniff, 9 (May 1959); National, 23 (April 1959); K.L.M., 12 (Sept. 1959); Western, 9 (late 1959)	128
Vickers Viscount	700 & 800 series	Rolls-Royce Dart	*See list below*	342
Vickers Vanguard	V.951	Rolls-Royce Tyne	B.E.A., 20 (March 1960)	20
Convair 880		General Electric CJ-805	T.W.A., 30 (late 1959); Delta, 10 (1959)	40
Fokker F.27 Friendship	Fokker-built	Rolls-Royce Dart 511	K.L.M., 4; Aer Lingus, 5 (late 1958); T.A.A., 6 (early 1959); Netherlands Government, 1; executive model for an Italian company, 1	42
	Fairchild-built		West Coast Airlines, 4 (Nov. 1957); Mackey, 2 (Oct. 1957); Frontier, 2 (Oct. 1958); Bonanza, 3 (Feb. 1958); Piedmont, 12 (late 1957); General Tire and Rubber Co., 1 (1958); Continental Can Co., 1 (1958)	
Handley Page Herald		Alvis Leonides Major	Queensland Airlines, A.N.A., and Lloyd Aero Colombiano—29; Air Kruise, 6	35
Frye Safari		Wright R-1300 or Pratt and Whitney R-1340	Wien Alaska, 3 (June 1957); Northern Consolidated, 3 (June 1957); Cruzeiro do Sul, 10 (end of 1957)	16

* An unspecified proportion of this total will be JT3 versions. † See page 458.

Vickers-Armstrongs Viscount (all models). The following list of confirmed orders, accounting for 342 aircraft, does not include unconfirmed but probable repeat-orders from Continental (5) and Indian Airlines (5): B.E.A., 26 V.701 (Dart 505), 1 V.701 (Dart 506), 24 V.802 (Dart 510), 14 V.806 (Dart 520); B.W.I.A., 4 V.702 (Dart 506); Aer Lingus, 4 V.707 (Dart 505), 3 V.808 (Dart 510); Air France, 12 V.708 (Dart 505); T.A.A., 6 V.720 (Dart 505/6), 1 V.720 (Dart 506), 5 V.756 (Dart 510), 2 V.816 (Dart 525); Indian Government, 1 V.723 (Dart 506), 1 V.730 (Dart 506); T.C.A., 15 V.724 (Dart 506), 21 V.757 (Dart 506); Hunting Clan, 3 V.732 (Dart 506), 2 V.759 (Dart 510); Pakistan Government, 1 V.734 (Dart 506); Iraqi Airways, 3 V.735 (Dart 510), 1 V.773 (Dart 510); Fred Olsen, 2 V.736 (Dart 506), 4 V.779 (Dart 510); Canadian Government, 1 V.737 (Dart 506); Misrair, 3 V.739 (Dart 506); Braathens, 1 V.742 (Dart 510); Capital, 3 V.744 (Dart 506), 72 V.745 (Dart 510); Butler Air Transport, 2 V.747 (Dart 506); Central African Airways, 5 V.748 (Dart 510); L.A.V., 3 V.749 (Dart 506); B.O.A.C., 8 V.754 (Dart 510), 4 V.772 (Dart 506); Hong Kong 2 V.760 (Dart 510); U.B.A., 3 V.761 (Dart 510); Hughes Tool Co., 1 V.763 (Dart 510); U.S. Steel Corp., 3 V.764 (Dart 510); Standard Oil, 1 V.765 (Dart 510); Indian Airlines, 5 V.768 (Dart 510); K.L.M., 9 V.803 (Dart 510); Transair, 2 V.804 (Dart 510); New Zealand N.A.C., 3 V.807 (Dart 510); Continental, 15 V.812 (Dart 525); Air Austria, 4 V.803 (Dart 510); South African Airways, 7 V.813 (Dart 525); Iranian Government, 3 V.782 (Dart 510); Lufthansa, 7 V.814 (Dart 525); Philippine Air Lines, 2 V.784 (Dart 510); L.A.I., 6 V.785 (Dart 510); South African Government, 1 V.781 (Dart 510); Pakistan Air Lines, 3 V.815 (Dart 525); Cubana, 3 V.755 (Dart 510), 4 V.818 (Dart 525).

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

In Search of Ideal Executive Aircraft

YOUR editorial specification for a light executive transport is of considerable interest, as my recent experience shows that it coincides with the requirements of a number of businessmen in this country who are at present operating aircraft which are not entirely suitable by modern standards.

Why, then, has the British aircraft industry ignored this requirement, particularly as there are indubitably others who, like myself, would welcome the opportunity of designing such an aircraft? Unfortunately, before undertaking such a design we have to convince our managing directors of two things: (a) that a ready market exists; (b) that we can design an aircraft which will capture a reasonable proportion of it. That is where the difficulties start!

First let us consider the potential market. At a price of £15,000-£20,000, people with whom I have discussed executive transport have estimated the requirement in this country as between 30 and 50 aircraft, although at such prices I would be surprised if it exceeded 35, which would keep the price nearer the upper end of the scale. This compares with £13,000 for the Piper Apache and £18,000 for the Cessna 310, but these aircraft are being produced at a rate of 35 and 21 *per month* respectively.

Quite obviously, no managing director will be happy at the prospect of the very considerable expense involved in producing only 35 aircraft, so a larger market is essential.

In world markets the proposed aircraft would be in direct competition with the Piper Apache, and in order to beat it the British product would need to be exceptionally attractive, as anyone who has studied the Apache will confirm. Regrettably, I can see no prospect of our designers producing such an aircraft and utilizing the available British powerplants in the 150 h.p. class, due to the considerable handicap which these engines impose. This is even more regrettable when one remembers that our large engines can match their counterparts anywhere in the world.

To appreciate the engine situation more clearly, let us compare the Lycoming O-320 with its British counterparts. The specific weight of the American unit, equipped with starter, generator and vacuum pump, is 1.87 lb/h.p.; the only British engines in the same category average 2.46 lb/h.p, or about 90 lb heavier when based on the nominal 150 h.p. The airscrew position is no more encouraging, for the only feathering unit available was designed for a considerably more powerful engine and weighs over 100 lb, which must be at least 40 lb heavier than the Hartzel airscrew used with the Lycoming engine.

Thus, on a twin-engined aircraft we carry a penalty of 260 lb, the effect of which is best illustrated by considering an Apache re-engined with British power units. In order to retain the single-engined performance the all-up weight must remain at 3,500 lb, so the following load analysis results:—

	Standard Apache.	"British Apache."
Tare weight ...	2,158 lb	2,418 lb
Fuel	522 lb (700 miles)	447 lb (600 miles)
Oil	36 lb	36 lb
Passengers ...	640 lb (4)	480 lb (3)
Baggage	100 lb	75 lb
Radio and blind-flying insts	44 lb	44 lb
	3,500 lb	3,500 lb

So, instead of a delightful aircraft which virtually fulfils the *Flight* specification by carrying four people and baggage for 700 miles, we are left with an aircraft carrying three passengers (and correspondingly less baggage) over 100 miles' shorter range. Is it surprising that we have difficulty in convincing our managing directors?

From the foregoing it may appear that I am trying to lay the entire blame with the engine designers, and that may be rather unfair, but it is rarely appreciated to what a very large extent the airframe designer depends on the engine designer; what hope would there have been of selling Viscounts to America if they had been designed around four Merlins?

If we are not only to regain the lead which the Gemini first set in light executive twins, but also to sell this class of aircraft throughout the world, including America, the primary requirement must be a power unit having the same impact on light aircraft as the turboprop had on airliners. It must combine extremely smooth running with a lower specific weight than even American engines currently achieve. Then we shall have the basic necessity for "doing a Viscount" in the executive market and our managing directors will be only too happy for us to start design work.

So, slightly tongue-in-cheek, I wait with pencil poised and eager to start, whilst seeking to escape the wrath of engine manufacturers by signing myself

Sussex. DESIGNER.

First Woman to Fly

I FEEL that Mr. E. V. Hammond [Correspondence, August 17] is a little out of touch with his data on flying women. *Aérophile* of August 15, 1908 tells us that Mme. T. Peltier was the first woman to fly in an aeroplane (July 8, 1908); *Aeronautics* of October 1919 gives Gertrude Bacon as the first Englishwoman—in August 1909.

F. H. SMITH
London, W.1. Librarian, the Royal Aeronautical Society.

Airliners and Flight Refuelling

IN your issue of June 1 Geoffrey Dorman asked why flight-refuelling is not being widely used by B.O.A.C. and other airlines, and except for a very brief reply by L. F. E. Coombs (*Flight*, June 15) the question appears to remain unanswered.

Commenting first on Geoffrey Dorman's reference to the adoption of flight-refuelling by the U.S.A.F., there is a great deal of difference between military aviation and the operation of civil airlines. (Incidentally, I do not think L. F. E. Coombs intended to suggest that we cannot do what the Americans can; in fact they came to Great Britain for all their initial equipment, and most of their aerial refuelling practice is based on British developments.) In order to achieve military objectives it is often necessary for aircraft to fly to distant targets or to remain airborne for lengthy periods, and the cost of this (relative to the consequence of the results) may be of small moment; whereas for airline work the operating cost is of extreme importance.

The transfer of fuel after take-off and climb (a form of assisted take-off) is an expensive practice, especially if the tanker aircraft are not kept fully employed. It might be used for the forthcoming types of American jets, as an expedient, from airfields with insufficiently long runways—provided enough services are run to justify at least two tankers at each aerodrome.

Elimination of "technical" stops for refuelling is a possible use for flight-refuelling in which the saving could offset the tanker service cost. But this could result in the duplication of crew in the airliner which adds to the cost and reduces the payload. Additional food and water would have to be on board at take-off and there *might* be a passenger resistance to the long, unbroken period in flight. This also requires a high traffic potential to avoid prohibitive tanker costs.

The Atlantic route, connecting Europe's capitals with the main centres of population in North America, provides the greatest promise, both geographically and as regards density of traffic. Most of the towns concerned are situated some distance from the extreme seaboards along the Great Circle routes; thus the tankers may be stationed part way along the course with consequent reduction of their flight distance (but note that the airliners also can make use of such intermediate landing grounds when necessary, e.g. under conditions of head winds).

Maximum advantage is obtained when refuelling takes place at what may be termed the optimum point, i.e. so that the quantity of fuel on board at take-off is equal to that after refuelling, thus permitting the maximum payload. These points are very roughly 600 miles west of Ireland and 200 miles east of Newfoundland on the W. and E. flights respectively. In this way not only is an undesirable landing eliminated, with saving of time and money, but also the payload increment may be considerable—a two-fold gain.

There are, however, certain complications which have to be considered. In the first place the fuselage must be large enough to accommodate the extra potential payload and this could involve the provision of airliners specifically designed for the purpose, a lengthy and costly procedure not likely to be indulged in unless no doubt exists as to the outcome.

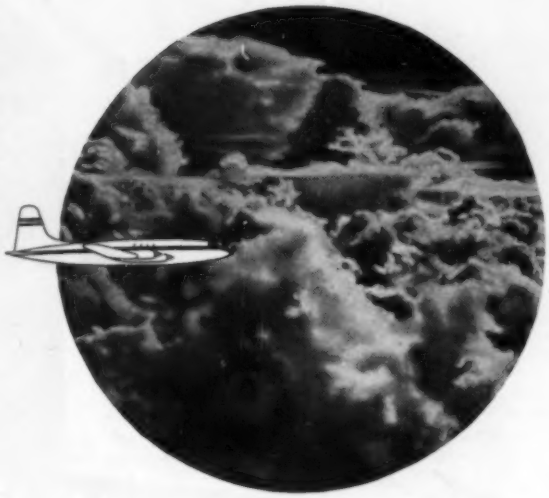
Rendezvous with an airliner must be exact in time and location: any delay means an additional fuel allowance on board the airliner (less payload), based on the maximum (not average) likely discrepancy. Jet airliners would need to be served by jet tankers if descent for refuelling and subsequent re-climb are to be avoided. Failure to meet the tanker, or failure to transfer fuel, though likely to be of rare occurrence, would result in the airliner returning to the nearest convenient base—which might involve flying 1,200 or more miles.

Apart from these niggling factors the prospects of employing flight-refuelling on the Atlantic route have all along been overshadowed by the promise of better and faster airliners, which the airline authorities believe will render the benefits of aerial *en route* refuelling less attractive, e.g. greater speed reduces the effect of headwinds. The forthcoming generation of jet airliners is expected to cross from London to New York in little more than seven hours, whilst on occasions of exceptionally heavy head winds an intermediate landing can be made at Gander.

Wonersh Park, Surrey. C. H. LATIMER-NEEDHAM.

EKCO electronics for aviation

The growing use of high-speed aircraft has focused attention on the value of Search Radar for weather-avoidance. Already, the B.O.A.C. Britannia Fleet is being fitted with EKCO Search Radar, a 3cm equipment which provides early warning of potentially dangerous cloud formations, warning of high ground in the flight path and provides map-painting facilities to assist navigation.



airborne search radar

With a range of 120 miles. Ekco Search Radar Type E120, incorporates the Iso-Echo Contour facility which delineates the areas of greatest turbulence within the cloud formation. The P.P.I. display shows two contours, one corresponding to the minimum detectable signal level and the other to a pre-determined amplitude above this level.

• • •

The Ekco airfield approach aid is a robust, extremely reliable equipment which has been designed to provide traffic control and bad-weather landing facilities for the smaller airport. It is operated by only one man, and can be installed in either a vehicle or the control tower.

. . . airfield approach aid

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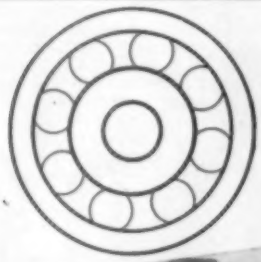

Phenomenal

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SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Battle of Britain "At Homes"

FORTY-FIVE R.A.F. stations in the United Kingdom will be open to the public on Battle of Britain Day, Saturday, September 15. Each will have flying and static displays showing a cross-section of the work of the R.A.F. Aircraft newly in service, including Vulcans, Comets, Javelins and Beverleys, as well as other types, will be seen at many stations, and there will be formation aerobatics by jet fighters.

Seven airfields near large centres of population will have specially varied programmes. They are Biggin Hill, Kent; Hendon, Middlesex; Horsham St. Faith, Norfolk; Thornaby, Yorks; St. Athan, S. Wales; Castle Bromwich, Birmingham; and Turnhouse, Edinburgh. At all stations admission will be free but profits from car parking and the sale of programmes will go to the R.A.F. Benevolent Fund and the R.A.F. Association. Last year 1,300,000 people attended and the funds benefited by £22,464.

The 45 stations, listed under counties and countries, are:—

Buckinghamshire, Halton; *Cambridgeshire*, Waterbeach; *Cheshire*, Hawarden and Hooton Park; *Cornwall*, St. Mawgan; *Devon*, Chivenor; *Essex*, Debden; *Gloucestershire*, Little Rissington; *Hampshire*, Andover and Thorney Island; *Huntingdonshire*, Wyton; *Kent*, Biggin Hill and West Malling; *Lancashire*, Kirkham; *Leicestershire*, Wymeswold; *Lincolnshire*, Binbrook, Hemswell and Swinderby; *Middlesex*, Hendon; *Norfolk*, Feltwell and Horsham St. Faith; *Northumberland*, Ouston; *Oxfordshire*, Benson, *Shropshire*, Ternhill; *Staffordshire*, Cosford; *Sussex*, Newhaven (marine); *Warwickshire*, Castle Bromwich and Wellesbourne Mountford; *Wiltshire*, Colerne; *Yorkshire*, Church Fenton, Dishforth, Leconfield, Lindholme, Norton and Thornaby; *Isle of Man*, Jurby; *Scotland*, Bishopriggs, Dyce, Kinloss and Turnhouse; *Northern Ireland*, Aldergrove; *Wales*, St. Athan, Porthcawl, Pembrey, Valley.

Exercise "Stronghold"

THIS year's major United Kingdom air defence exercise is called "Stronghold" and will take place between September 21 and 28. Its object is to test the air-defence system under all forms of attack. The defences will be directed by the A.O.C-in-C. Fighter Command, Air Marshal Sir Thomas Pike.

There will be two phases, the first from 1 a.m. on September 21 to 4 p.m. on September 23, and the second from 1 a.m. on September 26 until September 28. The latter phase will include some low flying over Eastern England, though not across heavily populated areas.

No. 31 Squadron's Standard

NEXT Thursday, September 13, No. 31 Sqn., the pioneer transport unit in the Burma campaign, and now a Canberra P.R. unit with 2nd T.A.F., Germany, is to receive its Squadron Standard from Air Chief Marshal Sir Alec Coryton at R.A.F. Laarbruch. Sir Alec was one of the squadron flight commanders in the early 1920s.

The battle honours chosen for the Standard are North-West Frontier, 1916-1918; Iraq, 1941; Egypt and Libya, 1941-1942; Burma, 1941-1942; North Burma, 1943-1944; Arakan, 1943-1944; Manipur, 1944 and Burma, 1944-1945.

No. 31 Sqn. was formed at Farnborough in 1915 for service in India and was stationed on the North-West Frontier until 1935. Just before World War 2 it started flying Valentia biplane transports. It carried troops to Iraq to help quell the Rashid Ali revolt early in 1941, at which time its equipment included a few Douglas DC-2s and some Atalantas. When Japan entered the war in 1941 No. 31 moved eastwards and operated from Rangoon and Calcutta.

Later, Dakotas arrived and the squadron put up a maximum effort for some time even though several of the aircraft had already logged 10,000 flying hours in America. Spare parts were short and improvizations, even to the extent of hybrid engine installations, became the order of the day. Supply dropping techniques were developed and used in support of Gen. Wingate's first Chindit operation in 1943. One No. 31 Sqn. aircraft landed on an 800-yd improvized airstrip in enemy territory to evacuate 17 wounded Chindits. In 1944 the squadron flew over 2,000 operational hours a month supporting the Chindits and the defenders of Imphal. After the war No. 31 joined Transport Command at Hendon and was reformed as a P.R. unit last year. The present C.O. is S/L. J. C. Stead.

Any past members who may wish to attend the ceremony should communicate with the Commandling Officer at R.A.F. Laarbruch, 2nd T.A.F., B.F.P.O. 43, Germany.

Radio Observers

THE wartime aircrew category of Radio Observer for all-weather fighters has been revived. The main task of aircrew so classified will be the operation of fighter radar equipment and such navigation equipment as is used. Since the war this has been done by navigators. Radio Observers will be non-commissioned officers and will be promoted to sergeant upon completion of training.

The A.O.C. Malaya, A.V-M. W. H. Kyle, is here seen at R.A.F. Kuala Lumpur after successfully completing his first solo in a Sycamore. The instructor was F/L. T. Carbis, Training Officer of No. 194 Sqn., which provided the machine.

SERVICE AVIATION . . .

During a recent visit to Malaya, the Air Member for Personnel, Air Chief Marshal Sir Francis Fogarty, presented a contemporary painting of a dragonfly to No. 194 Sqn., whose badge includes this emblem. Receiving it is S/L. C. R. Turner, the C.O.

"Sarah's" Success Remembered

THE first member of the R.A.F. to be rescued with the aid of his "Sarah" (Search And Rescue And Homing) beacon, F/O. N. Williams, then with No. 66 Sqn., Linton-on-Ouse, has been presented by the makers of "Sarah," Ultra Electric, Ltd., with a silver tankard bearing the inscription "Whose homely guidance saved him from the drink." F/L. Thompson, pilot of the rescue helicopter, was given an Ultra television viewer for his squadron's crew room.

New Angle

THE light fleet carrier *Warrior* has been recommissioned at Devonport after an extensive refit which included the addition of an angled flight deck.

1,500 Evacuations

OPERATING first Dragonflies and then Sycamores in Malaya, No. 194 Sqn. has now evacuated its 1,500th casualty from the Malayan jungle. Several pilots in the squadron, which is commanded by S/L. Turner, have passed the century in evacuations, and the 1,500th was made by F/L. W. Spencer, R.N.Z.A.F.

Royal Thai Air Force Mission

DURING this week a Royal Thai Air Force mission, led by the Deputy C-in-C., Air Chief Marshal Luang Chert Vuddhakas, has been visiting the Air Ministry and certain R.A.F. units in this country. The mission was also to see the S.B.A.C. Display, an aircraft factory, London Airport and Eton College, before leaving for New York.

Germans Attached

THE three German Air Force officers who recently completed R.A.F. flying training courses are now with Hunter squadrons on short attachments. Major W. G. Krupinski is with No. 41 Sqn., Biggin Hill; Lt-Col. H. A. H. Wehnelt with No. 222 Sqn., Leuchars; and Major G. F. Barkhorn with No. 257 Sqn., Wymeswold.

In Brisbane this example of winching between Sycamore and DUKW amphibious lorry was staged in public to show how the Australian Army and Navy could co-operate to save life in case of serious floods.

S.E.A.T.O. Naval-Air Exercises

LATER this month a S.E.A.T.O. naval-air exercise called "Albatross" will be held in the South China Sea. Operations will conclude in the Philippine area at the end of October.

Malayan Operations

IN the first six months of this year Austers and Dakotas from the "Voice" flight of No. 267 Sqn., based at R.A.F. Kuala Lumpur, broadcast for more than 300 hours in 337 sorties.

During the same period Valettas of the Far East Transport Wing, assisted by Bristol Freighters of No. 41 Sqn., R.N.Z.A.F., carried out 151 sorties in which they dropped more than 52 million anti-terrorist leaflets. They also delivered three million pounds of food and supplies. In addition, the R.A.F. Valettas dropped special para-packs containing food, clothing, tobacco and small luxuries for a group of 200 aborigines who recently escaped from a terrorist formation which had been using them as slave labour.

Strikes were made by Canberras and Venoms. Pioneers of No. 267 Sqn. undertook 3,524 sorties, carrying 1,736 passengers, 1,930 fully armed and equipped troops and nearly 400,000 lb of supplies and equipment. They evacuated 58 casualties.

No. 194 Squadron Sycamores made 2,899 operational flights, carrying nearly 1,000 passengers and 55,000 lb of freight. Whirlwinds of No. 155 Sqn. flew 5,187 sorties, carrying 7,441 troops and 88,000 lb of freight.

Another operation by the Far East Transport Wing was the dropping of members of No. 22 Special Air Service Regiment into south-western Kelantan for action against terrorists known to be hiding in deep jungle. Men of this regiment, which now includes a New Zealand squadron, are trained at the Far East Parachute Training School, R.A.F. Changi, Singapore.

R.A.A.F. Exercises

SEVEN R.A.A.F. Canberras of No. 2 Sqn. carried out a 6,500-mile round-Australia bombing and navigation exercise last month. They took off at three-minute intervals from their base at Amberley, Queensland, and, in a series of sorties, "bombed" Darwin, Perth, East Sale in Victoria and Evans Head in New South Wales. W/C. A. Cross of No. 82 Wing piloted the leading aircraft and the whole route was flown at 40,000ft in a flying time of 15 hours. The stages of the round trip were up to 2,000 miles long and the aircraft arrived over their targets within seconds of the planned time. The aiming points on each sortie were on bombing ranges.

W/C. Cross also set up a new officially timed speed record between Guildford, Western Australia, and Eagle Farm, Brisbane, by covering the 2,250 miles in 3 hr 20 min at a speed of 676 m.p.h. He made use of a strong jet stream. His aircraft was a long-range version of the Australian Canberra. S/L. H. W. Connolly, C.O. of No. 2 Sqn., made an officially timed flight from Darwin to Brisbane on August 7 in 3 hr 4 min at a speed of 580 m.p.h. The distance is 1,778 miles.

For an armament display at the East Sale Air Armament School two other Canberras made the 1,800 mile round trip between Amberley and East Sale in under three hours, dropping 5,000 lb live explosives on a target at East Sale. Both aircraft scored hits. Other demonstrations featured every operational aircraft in the R.A.A.F. except the Meteor. Lincolns at 6,000ft and 200ft bombed obsolete aircraft and Bren gun carriers, and Vampires demonstrated dive bombing and napalm attacks. Main item was an attack by Avon Sabres, each carrying sixteen 60 lb rockets, and by another Avon Sabre using its two 30 mm Aden guns. A Neptune made rocket attacks on a dummy submarine. A Lincoln attacked the same target and showed the technique of circling at 200ft to allow mid-upper and tail turret gunners to strafe the dummy. This is the technique used in Malaya against bandit camps.

Auxiliary Appointment

IT is announced that S/L. S. Walker, a regular officer, is to command No. 611 (West Lancashire) Sqn., based at R.A.F. Hooton Park. He enlisted in 1942 and was posted to No. 22 Air School, South Africa, in 1944. After the war he joined No. 87 Sqn. in the Mediterranean and subsequently Nos. 250 and 112. After a tour with No. 6 Sqn. he returned to England and flew with No. 631 before going to Sylt to convert pilots onto Tempests. Between 1950 and his present appointment he served with Nos. 20 and 612 Sqns. and with No. 233 O.C.U.

Good Shot

IN the trials for the British Olympic shooting team at Bisley recently, F/L. H. A. Steele gained a place for the pistol events. He took part in the 1948 and 1952 Olympics and this year became R.A.F. pistol champion for the third time. He has held both the R.A.F. and N.R.A. Service rifle championships.

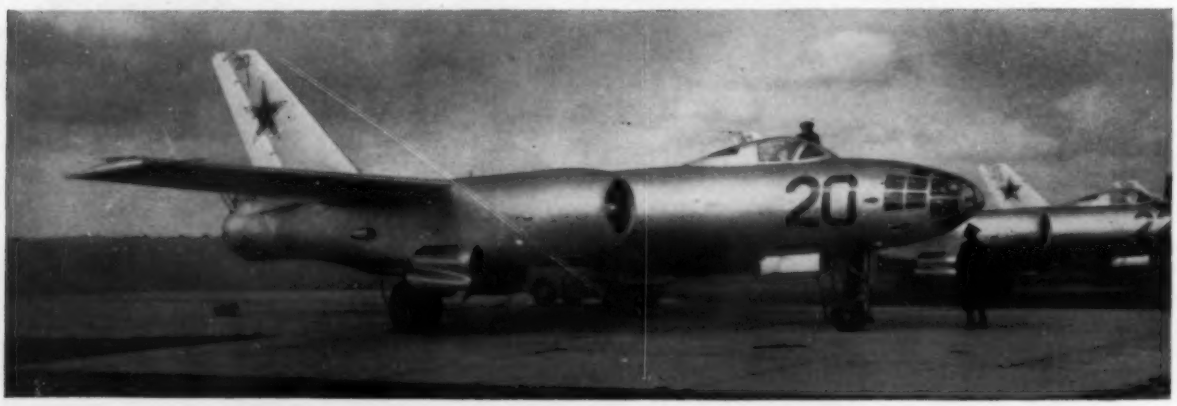
Reunion

ON November 3 a reunion of No. 612 Sqn. will be held in London. Details from W. N. Parsons, Wildcroft, Farm Lane, East Horsley, Surrey.

Il-28

The Withdrawal from East Germany of Russian Light Bombers

THESE photographs of the departure of seventy Il-28s from Oranienburg, Eastern Germany, are perhaps the best yet seen of a Soviet front-line unit. The aircraft left for Russia after the 221st Air Division had taken leave of the Germans at a farewell parade. Although designed almost ten years ago the Ilyushin light bomber is still an effective machine. Points worth noting are: manual controls, with tabs, inset hinges, mass balances and a fixed tailplane; twin 20mm guns in the rear turret, which is pressurized and has an entry door designed for duty as a tail bumper and as a bale-out blast shield; emergency oxygen in personal parachute-packs; facilities for bombing by radar and visual sight; de-icing air outlets at the wing tips; hinged landing lights in the cowlings; electric starting from a trolley plugged in near the tail; a dielectric panel in the canopy fairing and a long wire aerial leading in under the tail; ejection seats for pilot and navigator in the bomber and for pupil and instructor in the trainer (nearest machine in the top picture), the latter having no apparent fixed gun armament but a reflector sight in each cockpit. The engines are developments of the Rolls-Royce Nene.



THE INDUSTRY

Rotol-Messier Appointment

A JOINT announcement by Rotol, Ltd., and British Messier, Ltd., states that Mr. B. S. Clark has resigned his position as sales manager of both companies and is succeeded by Mr. Herbert Newport as from September 1. Mr. Clark is to take up an appointment with the Garrett Corporation of the U.S.A. as their European representative.

Mr. Newport, previously technical sales manager of the two companies, joined Rotol, Ltd., on its formation in 1937 after being with the Bristol Aeroplane Co., Ltd. In 1952 he opened the Australian office of Rotol, Ltd., in Melbourne and remained in Australia for two years, before returning to the main factory in 1954 to become technical sales manager.

New and Revised British Standards

THE British Standards Institution recently announced the publication of a new standard, B.S.R.2, specifying basic characteristics of radio service selection and intercommunication systems for civil aircraft. It deals with the inter-relating characteristics of aircraft radio receivers, transmitters and audio amplifiers that will enable them to be operated in conjunction with a mixing system or directly with the types of headphone and microphone in general use. Copies can be obtained at 3s. from the B.S.I. Sales Branch, 2 Park Street, London, W.1.

Also published are the following revised standards, obtainable at the prices shown: 2A 116, *Steel pan-head bolts (unified threads) for aircraft* (4s); 2A 117, *Corrosion-resisting steel pan-head bolts* (3s 6d); 2A 171, *Aluminium alloy pan-head bolts* (3s).

Gyroscopic Flight Instruments

NOW published is the sixth edition of Sperry's booklet *Aircraft Gyroscopic Flight Instruments*. This issue is considerably larger, with 130 pages and 81 illustrations covering the basic principles of aircraft gyroscopic equipment, as well as detailed descriptions of the range of instruments and autopilot equipment manufactured by the Sperry Gyroscope Co. It includes a description of the latest Integrated Instrument System as specified for B.O.A.C. DC-7Cs and Viscounts on order for K.L.M.

Much of the explanation of basic principles, an important feature of earlier editions, has been retained, but in some cases it has been amplified or re-arranged. The new edition contains a radically revised chapter with 60 test questions designed to consolidate in the reader's mind all aspects of the subject.

Since *Aircraft Gyroscopic Flight Instruments* was first published it has become one of the standard reference books on the subject. Its size and scope have grown considerably through the years and this sixth edition is nearly 50 pages longer than the fifth. Copies are available, price 6s post free, from Sperry Gyroscope Co., Ltd., Great West Road, Brentford, Middlesex.

Nimonic 100 Data

HITHERTO unpublished data on Nimonic 100, the latest alloy in the Wiggin series, has been released. Some typical figures for the material, which has a specific gravity of 8.04 and melting range of 1310-1380, are are follows:—

CREEP CHARACTERISTICS AFTER FULL HEAT-TREATMENT

Deg C	Stress (tons/sq in) to produce creep extension of								
	0.1% in (hr)			0.2% in (hr)			0.5% in (hr)		
	100	300	1,000	100	300	1,000	100	300	1,000
815	13.4	10.6	(7.7)	15.4	13.0	(10.0)	17.2	14.6	12.0
870	7.7	(5.4)		9.4	(7.0)		10.4	7.9	(5.3)
940	3.2	(2.1)		4.0	3.1	(1.8)	4.8	3.8	2.7
980									

Note: Extrapolated figures are shown in parenthesis.

ROTATING BEND FATIGUE PROPERTIES

Temp (°C)	Stress Range (tons/sq in)	Endurance
750	0±28.0	45×10^6 cycles in about 300 hours
815	0±24.0	
870	0±19.5	
940	0±11.5	

IN BRIEF

Mr. A. L. B. Dawson, M.I.Mech.E., A.M.Inst.C.E., A.F.R.Ae.Soc., managing director of the Self-Priming Pump and Engineering Co., Ltd., Slough, Bucks, has also been appointed chairman of the company as from August 1.

* * *

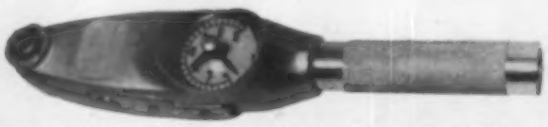
Two appointments are announced by Black and Decker, Ltd., Harmondsworth, Middlesex; Mr. F. W. McCartney is now assistant general manager and Mr. W. O. Bell, A.M.I.P.E., acting production director.

* * *

F. G. Miles, Ltd., Shoreham Airport, Sussex, announce the formation of an electronics division to deal with increasing work in the design and production of flight and system simulators and procedure trainers. The manager and chief engineer of the new division is Mr. C. H. Bickerdike, formerly a civilian scientific officer in the Royal Navy and subsequently chief projects engineer at E.M.I.; he was later with the flight simulator division of Redifon, Ltd.

* * *

Additionally to the makers' list of material and component suppliers for the Handley Page Herald, published with our recent description of the aircraft, the Saunders Valve Co., Ltd., understand that, in addition to non-return valves, three types of their spherical plug valve are used in the control of the fuel and oil systems.



One of the range of ratchet-operated torque-indicating wrenches made by M.H.H. Engineering Co., Ltd., of Bramley, Surrey. Accuracy to within plus or minus 3 per cent is guaranteed, and certain models can be provided with warning light signals.

A Canadian branch of the Martin-Baker Aircraft Co., Ltd., of Higher Denham, has recently been established at Collingwood, Ontario. The plant there is now manufacturing Martin-Baker ejection seats for CF-100 and CF-105 aircraft. The parent company informs us that the agreement with Canadian Flight Equipment of Cobourg, Ontario, under which C.F.E. manufactured and overhauled Martin-Baker ejection seats (referred to in our issue of August 24), was terminated in July.

* * *

In announcing its programme of courses for 1956-57, the School of Gas Turbine Technology, Farnborough Place, Farnborough, Hants, which is operated by Power Jets (Research and Development), Ltd., points out that the existing practical course is to be extended in scope. This change will come into effect from No. 123 Course, which is due to be inaugurated on January 21 next year. The revised course, while retaining all features of the old, will have certain new items, including "a test on a shaft-power engine as well as on a jet engine." Its purpose is to give a good overall picture of gas turbines in general from the points of view of manufacture, construction and operation, as distinct from theory.

* * *

Mr. David H. G. Ince, D.F.C., B.Sc., has joined British Oxygen Aro Equipment, Ltd., as sales manager. He was formerly concerned with aircraft sales and technical liaison at Elliott Brothers (London), Ltd., and before then was base manager for Hunting Clan Air Transport, Ltd., at Bovingdon Airport. Mr. Ince is an A.R.B.-approved glider test pilot and holds the International Gold "C" with one diamond. He assists Elliotts of Newbury, Ltd., with test and demonstration flying.

Mr. David Ince, whose new post is announced above.

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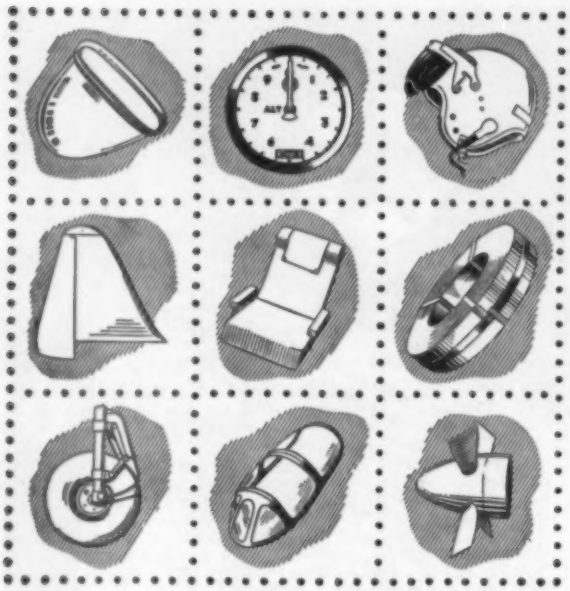

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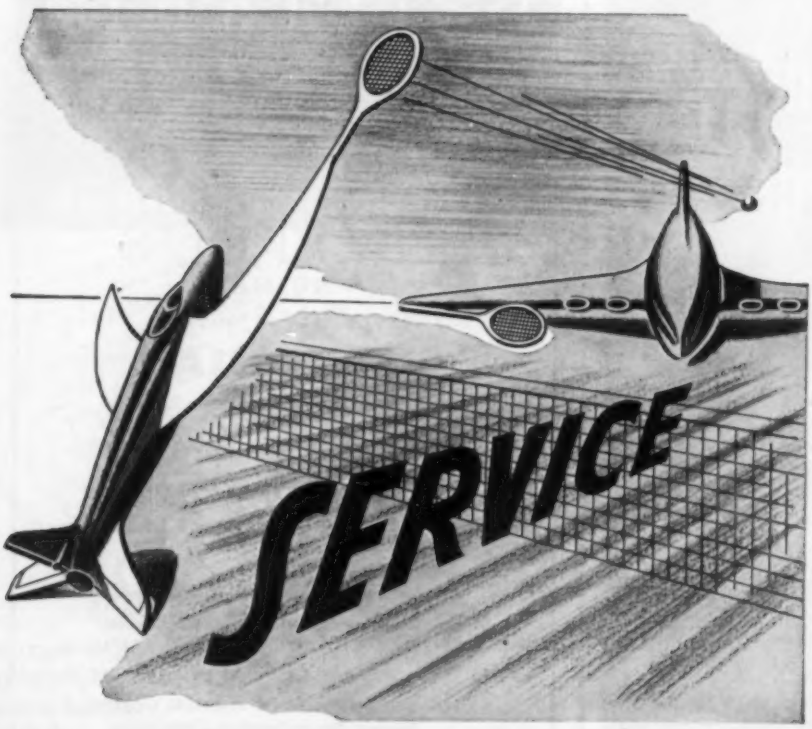

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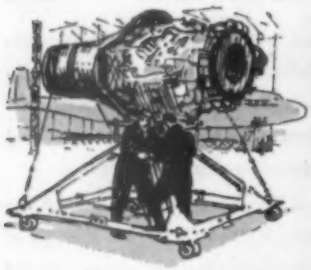

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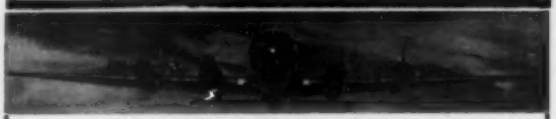

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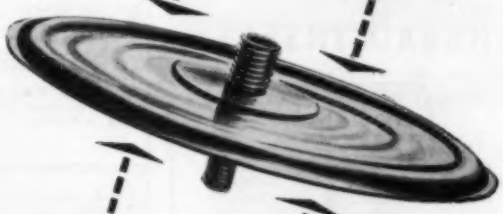

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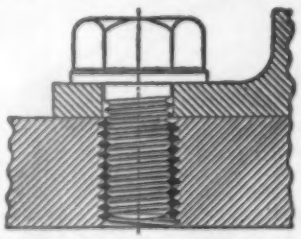

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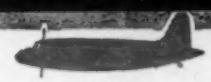

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:

APPLICATION No. 410/1. From Silver City Airways, Ltd., of 1, Great Cumberland Place, London, W.1, for an amendment to the terms of approval of the Freight and Vehicle Ferry Service which they are authorised to operate for the period up to December 31, 1961, on the route London (Blackbushe) (optional stop)—Birmingham (Elmdon) (optional stop)—Formby (Woodvale) (optional stop)—Belfast (Newtownards), so as to include an optional traffic stop at Isle of Man (Ronaldsway).

FROM B.K.S. Air Transport, Ltd., of 1, Marylebone High Street, London, W.1: Application No. 922. For a Normal Scheduled Service with Dakota and/or Viking aircraft for the carriage of passengers, supplementary freight and mail between Leeds (Yeadon) and Amsterdam at a frequency of up to seven return flights weekly for a period of seven years, commencing one month after date of approval.

APPLICATION No. 470/1. For continued approval of their Normal Scheduled Service with Dakota and Viking aircraft for the carriage of passengers, supplementary freight and mail, between Leeds (Yeadon) and Dusseldorf via Southend (optional technical stop) at a frequency of from two to seven return flights weekly, for a period of seven years, commencing May 25, 1957.

APPLICATION No. 471/1. For continued approval of their Normal Scheduled Service with Dakota and Viking aircraft for the carriage of passengers, supplementary freight and mail between Leeds (Yeadon) and Paris (Le Bourget) via Southend (optional technical stop), at a frequency of from two to seven return flights weekly, for a period of seven years, commencing May 25, 1957.

APPLICATION No. 945. From Eagle Aviation, Ltd., of Marble Arch House, 32-50, Edgware Road, London, W.1, for a Seasonal U.K. Internal Service with Viking aircraft for the carriage of passengers, supplementary freight and mail between London (Blackbushe) and Jersey at a frequency of up to six return flights per week operated on Fridays, Saturdays and Sundays during the period from June 1 to September 30, 1957 inclusive.

APPLICATION No. 308/2. From Silver City Airways, Ltd., of 1, Great Cumberland Place, London, W.1, for an amendment to the terms of approval of their Internal Freight and Vehicle Ferry Service on the route Southampton (Eastleigh) and Guernsey, which they have been authorised to operate until September 30, 1961, so as to increase the number of passengers not associated with vehicles from six to nine on any one day in each direction.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [5699

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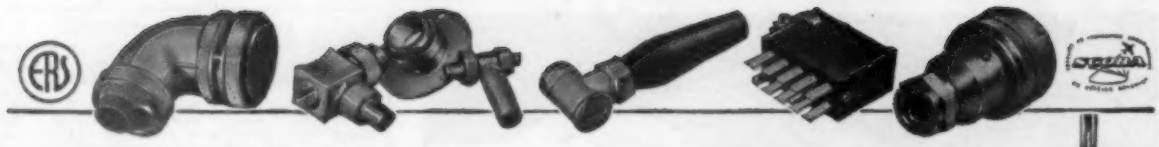

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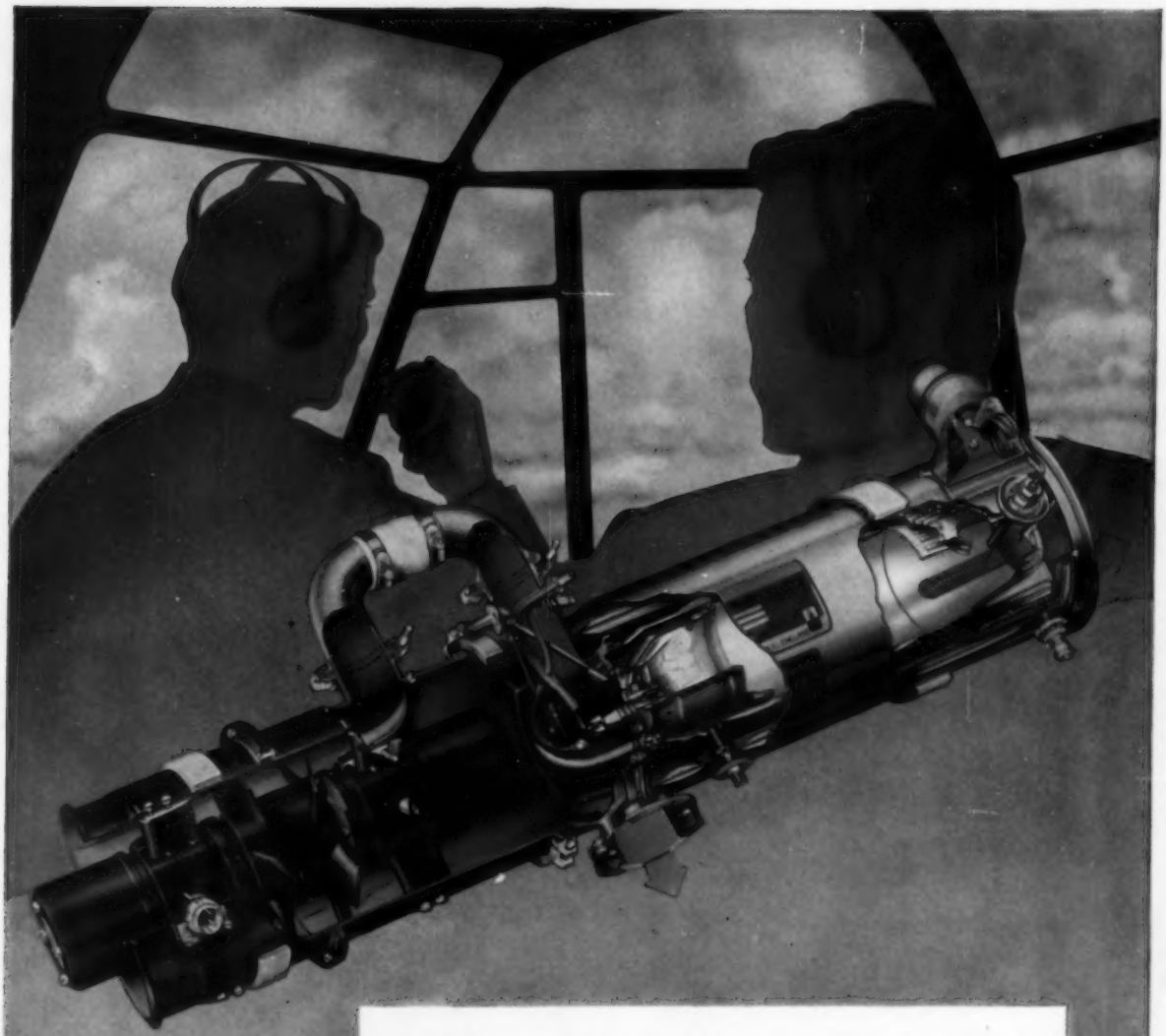

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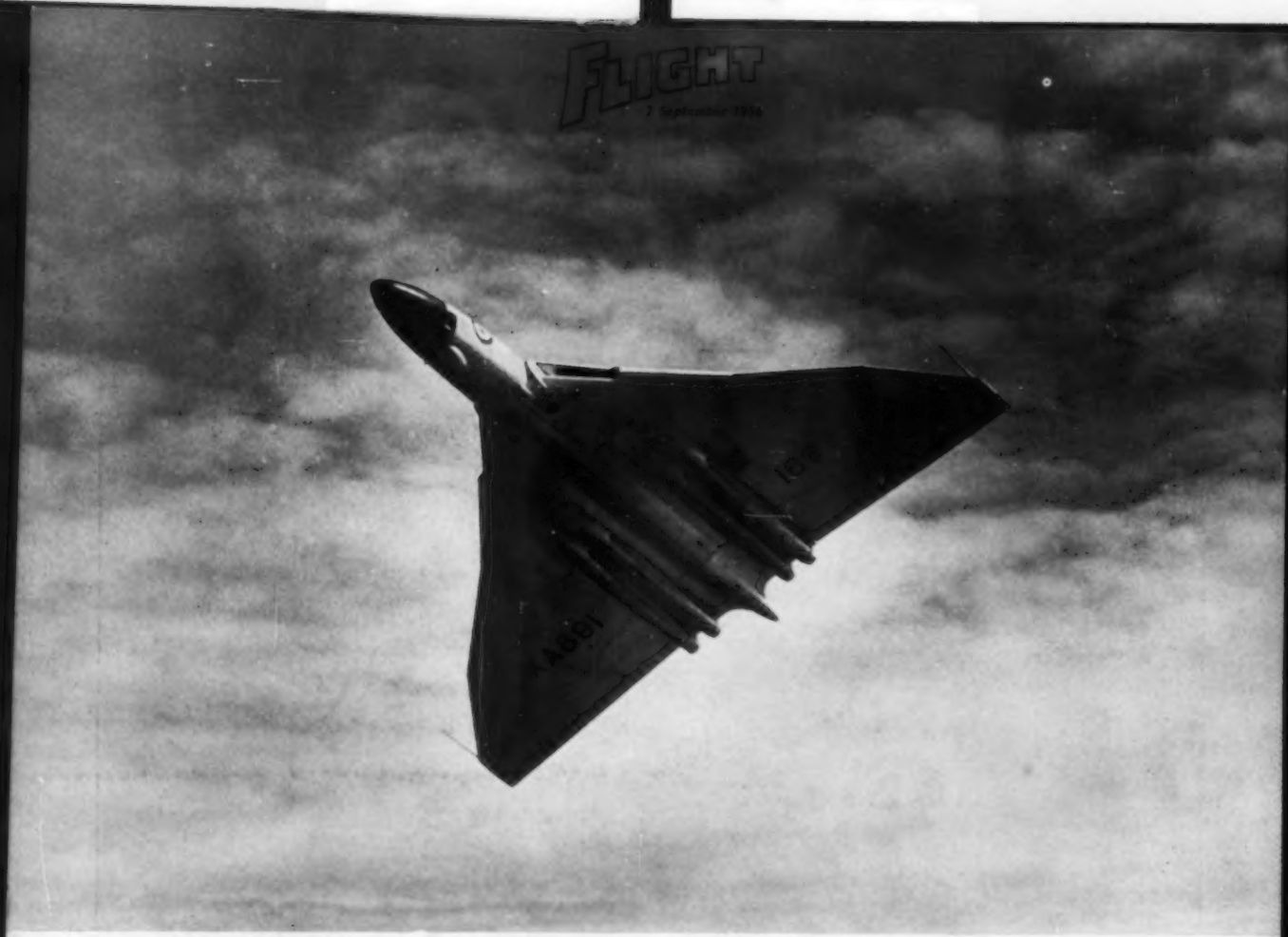

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